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THE BRICKBVILDER

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THE BRICKBUILDER.

AN ILLUSTRATED MONTHLY DEVOTED TO THE ADVANCEMENT OF ARCHITECTURE IN MATERIALS OF CLAY.

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CARE OF MASONRY.

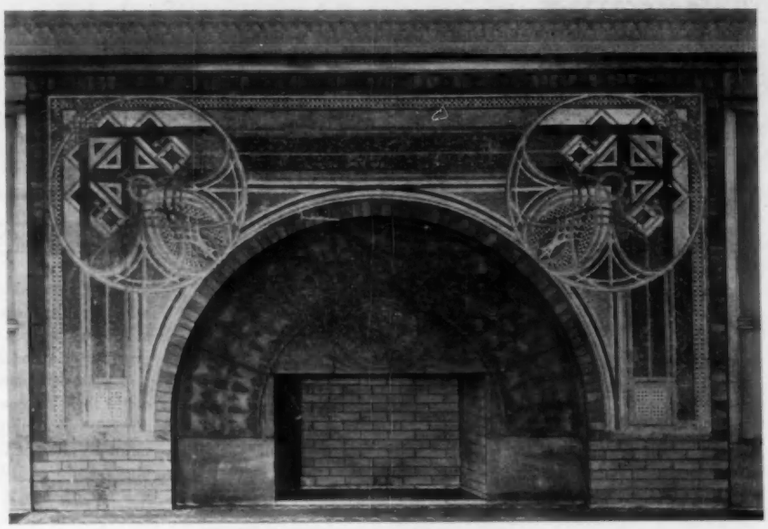
WE understand that Mr. Barnard R. Green, who has been in charge of the work of the Congressional Library in Washington for a number of years, if not from its start, has been appointed by Congress permanent superintendent and custodian of the building. This appointment points a moral which is deserving of more frequent application than is unhappily the case in American cities. Our architects and builders may put up a building never so fine, may use the best of material and the utmost care in application, but unless the structure receives intelligent care after it is occupied, and the repairs, which, from time to time, are necessitated in even the best of structures are made judiciously and with consideration for the character of the construction, the building is bound to deteriorate quite rapidly. And the fact that Congress has seen fit to recognize this condition and has placed the magnificent building permanently under the care of a person who is thoroughly familiar with it, and is competent to keep it in its pristine excellence, is, we hope, at least the beginning of a new order in regard to our public buildings.

The excellence, suitability, and permanent qualities of burnt clay as a building material, preeminently fitted for use in connection with modern structures, can hardly be questioned in view of the greatly increasing application of this material in our large cities. If properly taken care of, there is no reason why a brick and terra-cotta building should not last for centuries in perfectly good condition. On the other hand, any material is bound to suffer from neglect. It is not enough to build a brick wall and expect it to stand forever without any care, nor will the utmost skill in the use of concealed iron supports for terra-cotta avail to keep it in thoroughly good order indefinitely. It must be watched, and especially in our climate it must be repointed whenever the mortar shows signs of decay, and must be cleaned at sufficient intervals to prevent the formation of any of the fungous growths which attach themselves quite readily to building materials and speedily cause disintegration. For these reasons a custom ought to be adopted here, which has been for many years prevalent abroad, of assuming that the architect who builds a building is naturally the one in whose care as a structure it shall remain indefinitely, and that it is as much his function to guard his creation after it is turned over to the owners as it is to see that proper materials are used in the first place and laid up in the best manner. We believe that a great deal of the objection which has at times been urged against brick or terra-cotta has been suggested by observation of structures imperfectly cared for, which, with perhaps not the best of materials to start with, afford a too easy prey for the elements; and the fact that there are so many buildings of brick which have endured in this immediate vicinity for over one hundred years, and are still in a perfectly good condition, shows that with even ordinary good care brick or terra-cotta are practicably indestructible. Any one has but to examine the Harvard and Massachusetts Halls at Cambridge, which were built in the last century, to see how well brick will endure under proper conditions. On the other hand, we have seen buildings in which was used thoroughly first-class brick laid in the best of cement, which had been allowed to go to pieces, the frost had worked into the joints, and ten years after the structure was handed over to the owners it looked older and of apparently poorer materials than the Cambridge examples just noted. The practise now seems to be for the architect to build his building, and as soon as the contract is completed, roll up his drawings, pack them away, and speedily forget the structure, to concentrate his energies on the next job he is hunting for. Even if he remonstrates with his former client against neglect of his building his warnings are seldom heeded, for few property owners appreciate that a building must be not only well constructed but well groomed.

The points at which a building will suffer most are in the weatherings, where vertical joints are exposed on top of a horizontal course, such as top members of cornices, sills, copings, etc. Some constructors are unwilling to use terra-cotta for any of these purposes, knowing how seldom an owner will intelligently appreciate the necessity for attention to such features, though so much better effect can often be secured that it is well worth the price of a careful inspection each spring by a competent mechanic, and a few dollars expended in some good old-fashioned pointing with a mortar of lime and sugar, or of one of the cements which will not stain the terra-cotta. We recall at this moment a prominent commercial building all of the details of which are of terra-cotta, including a heavy, foliated band at line of upper floor which serves at intervals as a sill for the windows, and of necessity presents many vertical joints, protected only at top by the pointing. The annual bill for repointing, during the last five years, has not averaged twenty-five dollars. In September and in March it is gone over under the architect's direction, and possible repointing anticipated. If this supervision is continued, the terra-cotta ought to last for centuries.

But pointing is not all. Conversing with a builder from a city where soft coal soot is painfully in evidence, we found he was not in favor of using enameled terra-cottas or brick for external treatment

of city fronts, for the reason that even the best enameled surface will catch the dust and soot and in a short time will look like ordinary brick or terra-cotta. He seemed to think a suggestion of applied soap and water was impracticable. That is like saying, if one's hands are dirty, there is no use washing them, for they will soon become dirty again. We, in Boston, are fortunately spared the sooty atmospheric conditions which afflict our Western cities, but there is plenty of dirt here, nevertheless, and if a building is to be the joy forever which its possibilities will permit, its toilet must be regularly attended to. A terra-cotta front of 90 ft. by 125 ft. high can be thoroughly cleaned and repointed for less than $250, and this ought to be done at least once in three years, and in some localities once a year. And in the long run, it is believed that property owners would find such care bestowed upon a building would be well worth all it would cost in money, while the esthetic gain to the community would be no less real, if less easy to reckon in dollars.



BRICK, TERRA-COTTA, AND MOSAIC MANTEL, BANQUET ROOM, ST. NICHOLAS HOTEL, ST. LOUIS, MO.
Louis H. Sullivan, Architect.

THE PALAZZO POLLINI SIENNA.

THE Palazzo Pollini is one of the smaller brick palaces of Sienna, but it at once attracts attention by the beauty and correctness of its proportions. The façade is divided

into three stories, of which the first has a very decided batter. There is no ornament of any kind about this story. The principal story has marble architraves, and caps to the windows, and the third story has also marble architraves.

Some of the belts are of marble, and some of molded brick. The wall is capped with a very rich terra-cotta cornice, and wide projecting eaves. The interior presents nothing of interest; the design is attributed to Baldassan Peruzzi. A measured detail of the building is shown on plate 48.

OBITUARY.

MR. W. S. FRASER, architect, of Pittsburg, Pa., after an illness of nine months, died at his home, April 27, at the age of forty-five years.

Mr. Fraser studied architecture at the Royal Academy, London, and with William Burgess, one of the best known of English architects. In 1879, he opened an office at Pittsburg for the practise of architecture. Among the buildings designed by him are the Bank of Commerce Building, Arbuckle Building, Joseph Horne Building, and the Sixth U. P. Church, all of Pittsburg.

ILLUSTRATED ADVERTISEMENTS.

IN the advertisement of the Excelsior Terra-Cotta Company, page iv, is shown an interesting series of terra-cotta details of the Romanesque style, employed by Architect George L. Morse in the new store building for Abraham & Straus, Brooklyn.

BOHEMIAN NATIONAL HALL, New York City, the architectural terra-cotta for which was made by the New Jersey Terra-Cotta Company, is illustrated in the advertisement of that company on page ix.

A VERY interesting illustration of fire-proof floors is shown in the advertisement of R. Guastavino Company, page xiv. It shows to good advantage their system of fire-proof construction, the first floor being of the dome type carried on tile ribs with tension angle

WINDOW PEDIMENT.
Executed in terra-cotta by the New York Architectural Terra-Cotta Company.

irons built inside of same, and the upper floors of barrel arches with tile bracing ribs. The same dome floor construction is to be used for the first floor of the adjoining building and its duct system for hot air. This system of floor construction was selected because of the very heavy loads required. Rand & Taylor and Kendall & Stevens, architects.

Architectural Terra-Cotta.

BY THOMAS CUSACK.

(*Continued.*)

IN responding to numerous requests for reliable data on cornice construction, it may be advisable to start with one of rather commonplace character. Where the projection of a modillion cornice does not exceed 2 ft. 6 ins., it may be supported in the simple and inexpensive, but very effectual, manner shown at Fig. 22. Provision is made for a piece of 1 in. galvanized iron pipe, which is passed through the partitions of every modillion, the chambers of which are then filled from the top bed before setting. The wall would not be less than 12 ins., or more than 1 ft. 4 ins., and in either case the bond could be made the full thickness. If not, the end of the pipe would be allowed to extend to the inside face of wall. The introduction of the pipe serves a twofold purpose. It increases the strength of the bracket *per se*, and it affords a ready means of anchoring it down. Placing the anchor bolts on inside face of wall, instead of building them into the wall, has likewise some important advantages. It gives additional leverage, saves the trouble of exact spacing, and the rods do not stand up in the way of the masons while the wall is being built. The anchor plates are built in joint of brick piers, say, 4 ft. below cornice, and when over the window openings, as near the lintel as possible, in which case shorter bolts would be used. One end of the bolt being forged so as to fit tightly into end of pipe, the other end, passing through the hole in anchor plate, is screwed down to required tension by nut on the under side. The spaces between brackets being then built up level, the top member of cornice is set to line, and in most cases it may be anchored back to roof beams, after the manner indicated in section (Fig. 22).

Where a parapet wall is intended, its weight when built would help to counterbalance the projection of cornice. That is a factor worth taking into account in fixing the length and size of the anchors, but must not be used as an excuse for abandoning them. There have, however, been instances known to the writer where they were omitted by the contractor, although provided for in making the terra-cotta, and specifically called for on the setting drawings that accompanied it to the building. This kind of "economy" is usually shortsighted, and in one or two cases it has proved criminal.

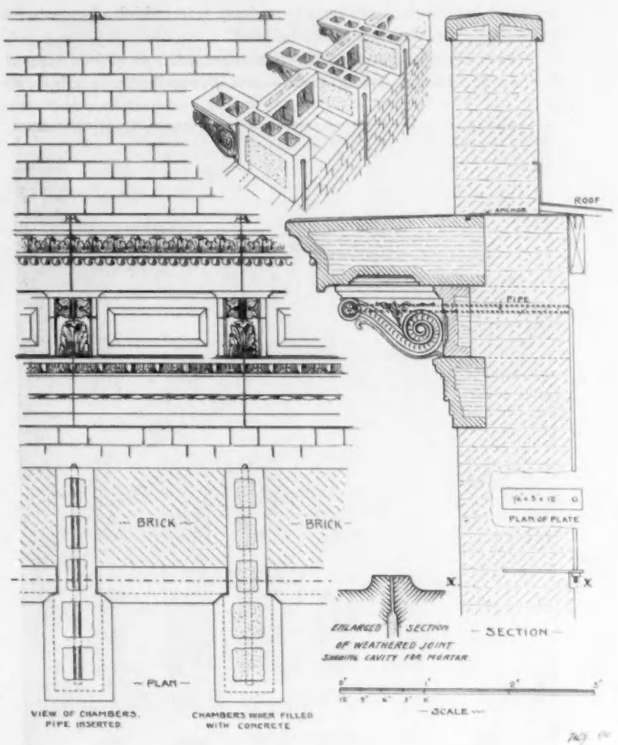


FIG. 22.

A portion of the cornice toppled over onto the scaffold, which also gave way, and in each case with disastrous consequences, resulting in a loss of life, which was directly due to the omission of a few inexpensive and easily applied anchors. In all work of this kind it is certainly "better to be sure than sorry."

Within the limits stated, viz., 2 ft. 6 ins. projection, this arrangement possesses a wide margin of safety. A glance at the diagram will show that if this cornice, when set, be tested by loading it beyond the verge of stability, it would not be the modillions, nor yet the anchors that must fail, but the wall itself, which would break at x x,—obviously its weakest part. To do this, however, would require a much greater weight than is at any time likely to be placed upon a cornice, and the tendency in that direction is fully counteracted by the anchors attaching it to the roof timbers. A scheme substantially the same as this was submitted some years ago, by the writer, to a leading firm of architects, and having received their approval, was carried out. It has again been adopted by them, and

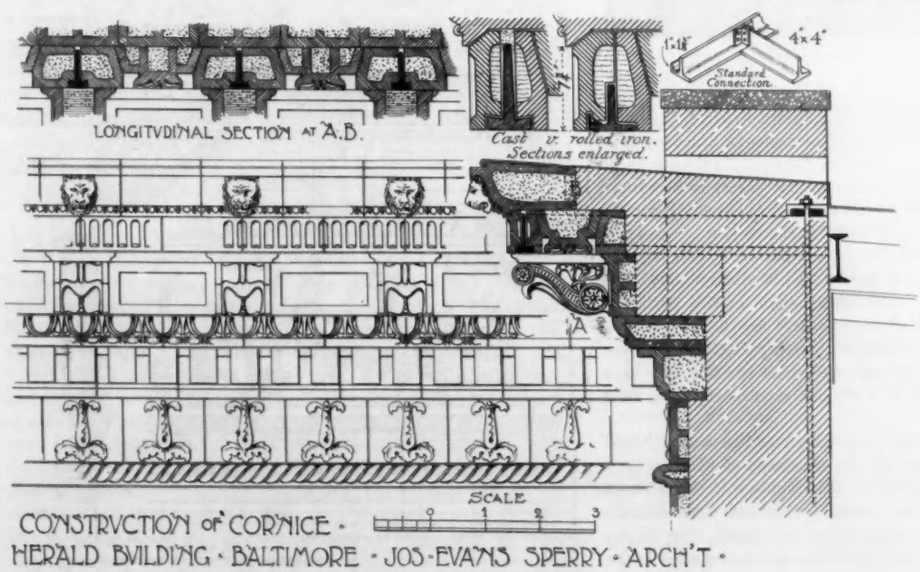


FIG. 23.

by other architects on several occasions, from which circumstance its efficiency may reasonably be inferred.

In cornices of greater projection, other schemes of iron support become necessary. One of these — and an excellent one it is — we

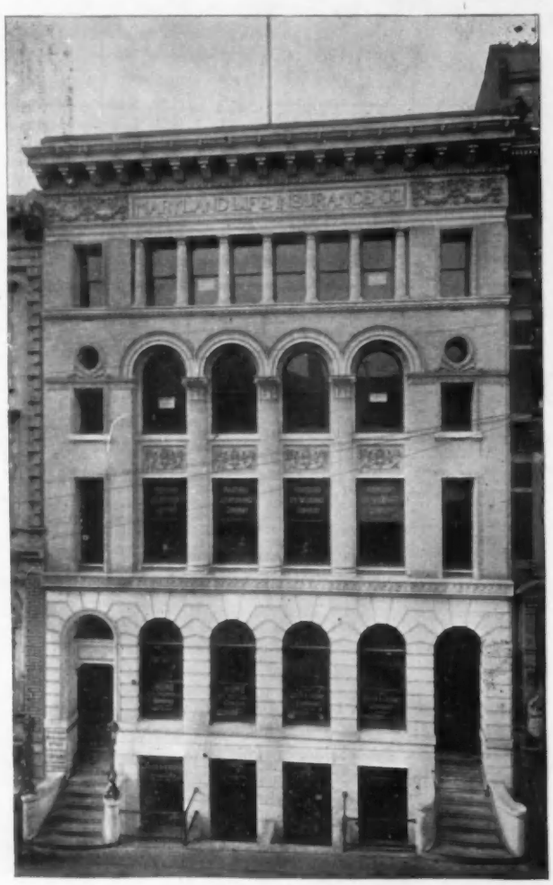


FIG. 24.

give at Fig. 23. For this device we are indebted to Mr. J. E. Sperry, Baltimore; and considering the number of times he has used it on important buildings without much modification, there can be no doubt as to its practicability. The first special feature to be noticed is that the cantilevers, as well as the inverted tee running parallel with the building, are *cast* iron. In this he claims two advantages: one being that they are less liable to rust; the other, that a flange such as shown in drawing cannot be obtained in rolled sections. In so far as the cantilevers are concerned, the value of this particular section is not apparent, but in the longitudinal tee its advantage is very decided. The pieces of terra-cotta forming fascia fit into the dovetail angle in such way that when the crown molding has been set they are securely locked, and do not require any additional anchors.

We think, however, that the same thing could be accomplished by using an ordinary rolled section, on one flange of which a small angle of, say, 1 by 1½ ins. may be riveted, as shown in the enlarged section. Or, a special tee, known as No. 156, may be obtained from the Carnegie works which approximates sufficiently close to the casting to change places with it. This would not be required in the soffit blocks, where eight pieces are fitted into each compartment, with an iron frame on three sides, and a brick backing on the fourth. Seven of these pieces being set in place separately, it but remains to drop in the center panel as a key, and the whole thing is then rendered immovable. There can be no doubt as to the stability of a cornice made and erected in this manner. The only serious objection to any part of it is the exposure of the longitudinal tee, in soffit between the modillions, which would have to be painted to match the terra-cotta. How that may be avoided will be shown in subsequent illustrations, where cornices of much greater projection are carried without exposing any of the iron construction. In view of what has just been said in connection with this one, however, we have taken the liberty of reproducing another of Mr. Sperry's cornice designs, applying to it a style of construction and support which would be less expensive, and, we think, preferable in other respects.

The Maryland Life Building, Baltimore (Fig. 24) has a cornice, the construction of which is substantially the same as that discussed in the two preceding paragraphs, and shown in detail at Fig. 23. In the revised method now proposed (Fig. 25) two radical changes are introduced, which, being made, would involve a third. Instead of the cast-iron cantilevers, which have been shown to possess no special merit, we would use a 4 by 4 inverted tee of rolled iron, tailed down by similar anchor bolts; and as these pass through a continuous channel, they need not be less than, say, 5 ft. apart. The longitudinal tee bolted to the cantilevers is omitted altogether, it, as we shall see, being rendered quite unnecessary. These two changes compel, or rather permit us to make each piece of cornice in one piece from center to center of modillions, with coffer panel and rosette in soffit solid and complete. The blocks so made rest directly on the flanges of the cantilevers, the web in each case being provided for by a slight rebate in the joint. The modillions have little more than their own weight to carry, and being deep in proportion to their projection, might well be considered self-supporting. Yet, in view of possible fracture in transit, or of chance knocks during setting, we would insert a pipe in each of them, filling the chambers with concrete, as in Fig. 22. The terra-cotta maker would not charge any-

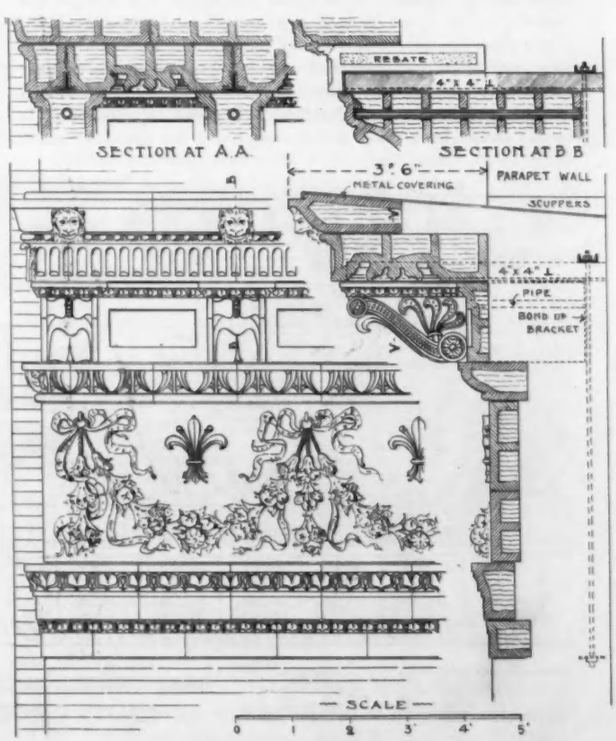


FIG. 25.

thing for the hole; and the use of a few feet of pipe and a little cement, while enabling the contractor to sleep soundly in his bed, would never drive him into bankruptcy.

In saying that this arrangement would *permit* these blocks to be made in one piece, instead of in ten pieces, we use the word advisedly, for in that there are certain advantages that do not appear on the surface. To joint work into pieces unnecessarily small is hardly less objectionable than to insist upon having them made too large. Excessively small blocks were often resorted to in past years by men who had not learned how to make large ones. The alleged intractability of the clay was often enough made a convenient scapegoat for their own shortcomings in the use of it. While it is gratifying to know that some of these men are gravitating towards the rear of the procession, there is reason to fear that the class still survives. A few instances of recently executed work show but too plainly that it is not yet wholly extinct. Architects have at times been talked into acquiescence, accepting in half a dozen small pieces a single member that any really competent clay-worker would have elected to make in one, and that, too, without doubt or misadventure. We see in Mr. Sperry's scheme a well-considered and altogether praiseworthy effort to overcome a supposed deficiency in the material, but one which, we are glad to assure him, can be overcome to a much greater extent than he has been led to suppose.

The particular block which we propose to make in the present instance is 3–0 x 2–9 x 10 and would weigh, when burned, about 500 lbs., or less than one third the weight of blocks which have been made with unqualified success. This, indeed, would be considered an almost ideal block in point of shape, as well as in that of size, and, what is of equal importance, its situation is such that true alignment is imperative only on face and soffit. It, as the drawing shows, may be pressed open on the top bed, which would compel the mason to fill the chambers, in itself a thing to be commended. In this and in many other respects, not only would it be *better* in one piece than if made in ten pieces, but it would likewise be produced at considerably less cost.

One mold of medium size would certainly cost less to make than eight separate molds, required under the previous system of jointing. In like manner, we have but one block to press against the ten distinct pieces otherwise necessary to make up its equivalent in cubic inches of work. The comparison begins, but it does not end here. Instead of one piece, we have ten pieces to handle in all subsequent stages. Even when burned, we have them to assemble, to fit, mark, ship, and finally to set when they reach the building. Whether viewed as a question of good construction, or as one of profit and loss, the balance is decidedly in favor of the solid block, as against the ten pieces. It will therefore be seen that even in terra-cotta making "the first false step" is fraught with and followed by a train of evil consequences — a sufficient reason why it should be eschewed at the outset.

(*To be continued.*)

WE haven't been very busy in the office lately. In fact the hard times have left us almost stranded, a condition which we feel we share with a great many others. It has some compensations, however. I have been amusing myself lately with a design for an office building, and as it costs no more to build one way or another on paper, I ran to the limit, and piled on some fifty odd stories, with a total height of about 750 ft. Of course it is a beast, and no client in his senses would ever allow an architect to indulge in such vagaries except on paper, but it is good fun, all the same, and some of the problems which have cropped up have been very interesting. Of course I am building the whole thing of brick. That goes without saying. But of course, also, the brick is only 16 ins. thick with the steel skeleton inside of it. To carry out the delusion of persuading myself that this was serious fun, I figured up the wind strains and found that with a pressure of 30 lbs. per square foot on the off side of the building, which measures, by the way, 100 ft. wide and 600 ft. high, the added strains on the opposite columns at the maximum would only amount to about 54 tons, which is pretty inconsiderable when we reflect that each column has about 2,500 tons load upon it. It looms up in great shape and is an example of brick construction which would delight your editorial heart and would strike terror to the souls of our legislators who are trying so hard to slice off all our buildings horizontally to a ridiculously minimum height. — *Subscriber.*

CLUB NEWS.

AT the annual meeting of the T Square Club the following officers were elected for the ensuing year: president, David Knickerbacker Boyd; vice-president, Edgar V. Seeler; secretary, George B. Page; treasurer, Horace H. Burrell.

These officers, together with the following, also elected, comprise the executive committee: Walter Cope, Louis C. Hickman, and Chas. Z. Klauder; house committee: Adin B. Lacey, chairman, Chas. E. Oelschlager, and Percy Ash.

In the regular monthly competition entitled "Farmstead," first mention was awarded Lloyd Titus.

THE ST. LOUIS ARCHITECTURAL CLUB held its regular monthly meeting on Saturday evening, May 1. The club decided to hold an exhibition at the club rooms on May 17 to 22. An interesting talk was given by Mr. Frank A. P. Burford, about Mexico, where he has spent the past year.

THE semiannual meeting of the Detroit Architectural Sketch Club was held April 26, and elected the following officers: Alexander Blumberg, secretary; vice, Edward A. Schilling; directors, Augustus O'Dell and John A. Gillard; vice, Alex. Blumberg and M. S. Willcox.

THE PITTSBURG ARCHITECTURAL CLUB gave its first reception in honor of Prof. Wm. H. Goodyear, April 23, 1897. The club rooms in the Ferguison Block were artistically decorated to suit the occasion, and many architects, artists, and their friends were present. A table covered with hundreds of photographs of medieval Italian churches, taken by Professor Goodyear while abroad, was the center of attraction. He spoke of his discoveries of curves in these churches in a very interesting manner. Save a Bohemian night that was indulged in a short time ago, this was the club's first entertainment.

NEW BOOKS.

MR. RUSSELL STURGIS has rendered a service to the student of art by forming, in a very handy, compact volume, an annotated bibliography of the subject, [1] to which is added a similar annotated list of works on music. It does not claim to be exhaustive; in fact, many of the works, which are chiefly illustrative, are not included in the list, but it mentions all of the well-known works and has a brief description, with price, etc., for each. It forms a very valuable aid to reference.

"HYDRAULIC CEMENT, ITS PROPERTIES, TESTING, AND USE," is the title of a new work by Frederick P. Spalding, Assistant Professor of Civil Engineering at Cornell University, member of the American Society of Civil Engineers.

The pages contain the results of a careful study of the nature and properties of hydraulic cement, and the various methods which have been proposed, or are in use, for testing cement.

The views of the author, as derived from his own observation of the behavior of cement in use or in the laboratory, have been stated without reserve, and free use has been made of the results of available European investigations. The recommendations of the recent commissions appointed in Europe for the study of the methods of testing materials are fully given in so far as they relate to cement. New York, John Wiley & Sons.

[1] "Annotated Bibliography of Fine Art: Painting, Sculpture, Architecture, Arts of Decoration and Illustration." By Russell Sturgis. "Music." By Henry Edward Krehbiel. Edited by George Iles. Boston, 146 Franklin Street. Published for the American Library Association Publishing Section by The Library Bureau. 1897. Price, 50 cents in paper; $1.00 in cloth.

Color in its Relation to Architecture.

BY ELMER ELLSWORTH GARNSEY.

THE importance of color in its relation to architecture has not been sufficiently recognized or emphasized among those who teach or practise architectural design; and it is difficult to understand why one of the universal sources of esthetic pleasure, one of the most compliant and resourceful aids to artistic expression, should be so neglected in our day.

It is no new thing, for the best architectural tradition exhibits an intense appreciation of and love for color from the Egyptian to the Renaissance periods, and we find it employed both within and without all sorts of buildings, in all sorts of materials, constructive and applied.

The love of color is a natural instinct; the children of civilization no less than the children of nature are sensitive to the brilliant hues of bird and flower, of sky and sea, and they are equally influenced by the gaiety and joyousness of certain colors, and the saddening hues of others.

Civilization and its refinements have given us a higher appreciation of color, as well as other things, and we crave harmony in its use, just as we demand harmony as well as melody and rhythm in music.

So we need not, and indeed ought not to think of architectural color as a violent laying on or building up of masses of crude and glaring hues, but rather as a skillful blending and refining of surfaces to a more harmonious *ensemble*.

Upon the walls of Egyptian temples were emblazoned the triumphs of kings and the every-day occupations of the people; and the Assyrian palaces bore long processions of men and beasts enduringly pictured on vitrified bricks; the Greek temples were made splendid by painted and gilded sculpture; and all of these, even in their decay, are evidences that the ancient architects considered the color of their buildings as the crowning finish of their work, and perfected this, as other details, as far as their abilities permitted.

It cannot be denied that to our modern ideas the lavish use of strong and even very brilliant color on the exterior walls of buildings and statuary seems barbaric and in questionable taste; yet we are not obliged to go farther in this matter than to experiment with small quantities of color, used with that reserve and caution which should characterize ornamentation of any sort.

We need emancipation in our art and architecture, not that each may follow some original and bizarre method of design, but emancipation from a state of mind which prejudices us against any legitimate means of increasing the efficiency of our artistic expression.

We are not to become archæologists, but we may begin by trying our experiments along the lines which have been followed by others before our time, that we may benefit by their experience.

It will be found that the Greeks used color with a fine appreciation of its value as a means of expression, that they employed cold and warm, light and dark colors to express depth and retreating surfaces, or brilliancy and advancing lines and spaces. The grounds of marble friezes were colored, that the figures of men and horses might receive the greatest distinctness and relief; capitals of columns and moldings were emphasized by strong colors, while shafts of columns and large wall surfaces received simpler and broader treatment in quieter colors.

Recent investigations have shown that these master artists employed polychrome decoration in architecture and sculpture much more generally and liberally than a superficial acquaintance with their ruined monuments and buildings would suggest; certainly to a degree absolutely unknown in modern work.

They sought to express the beautiful in all they attempted, and they touched nothing which they did not beautify. We may therefore be assured that polychromy, as practised by the Greeks, cannot fail to have been as carefully considered, and the results of as great value to us, comparatively, as their other accomplishments in architectural design.

Beneath the deep blue sky of Greece, the association of superb marble and glowing polychrome decoration suggests a most inviting mental picture; one which we may hardly expect to realize, with less responsive materials, beneath a gray and smoke-beclouded canopy. We may add greatly to the charm of our architecture, however, by considering more carefully the colors and textures of the materials of which it is constructed, and seek to combine "ideal color with perfect design."

Students of architecture are taught to think in gray, because, the professors say, the "mass and void" may be best studied and expressed in monochrome, and this seems to be sound doctrine. In the same way the young painter studies from casts in charcoal or crayon; but when the latter has mastered the rudiments of his art, drawing from the round, he is no longer held absolutely to a single gamut of grays and black, he begins to paint in color.

Why should not the student of architecture be taught in the same manner? Study the plan and elevation in gray monotone, but do not stop here; let the color of the composition be considered, and make a separate color study for each problem.

Surely if such a system were carefully followed up, we should not see so many "queer-colored" buildings along our city streets, many of which cause us to wonder if they are brick buildings with stone trimmings, or stone buildings with brick enrichment!

There is no dearth of fine materials at hand in America, quarries are giving up their treasures, and great establishments supply all sorts of brick and terra-cotta, varied in form, texture, and color; but there is a lack of taste on some one's part, or our buildings would be more interesting and creditable examples of architecture.

Our manufacturers of building materials deserve high praise for what they have accomplished, and no age has had so much reason to congratulate itself on intelligent labor successfully applied; and if American architecture does not reflect credit on its creators, no blame can be attached to those who supply the materials from which it takes its form.

The manufacturer supplies the demands made upon him; he does not create the demand; and when architects require brick or terra-cotta of a certain quality or color, a host of skilled men stand ready to execute their wishes. Science becomes the magician, and the whole world of nature is transformed into material ready for the artist's hand.

Color, like taste, is not a matter of simple individual preference or fashion; it is good or bad according to its suitability for given purposes or conditions. It is not for us to say this or that color must be the general tone of your building, for the wishes of the client must be considered, the site and its surroundings must affect our choice; but when the indicated material has been decided upon, and its color fixed, we may so combine it with other materials that it may become harmonious, not only as to its surroundings but to the best artistic traditions as well.

How to study color in its relations to architecture is to study the theory of colors and their relations to each other; and no one has made a more careful and complete analysis of these phenomena than the great Chevreul, a man who died, full of years and honors, a few years ago.

His book on color has been translated into English, and may be had in any of our libraries; but no architect or worker in the allied arts should lack a copy in his own studio. His theory of the harmony of the contrast of complementary colors may be considered the foundation of the study of color harmony; and while it is the most intense and powerful of color combinations, it is as well the simplest and widest in application.

Upon the hypothesis that there are three primary colors, red, blue, and yellow, combinations of any two of these producing the secondaries, violet, green, and orange, he arranges a diagram in which two concentric circles, divided into three segments, display the primaries in the inner and the secondaries in the outer circle.

Thus, red is opposite green, blue is opposed to orange, and yellow is opposite violet. These, then, are the complementary colors, and their opposition forces each to exhibit its greatest brilliancy; and when any two complementaries are employed together or in close proximity, they heighten each other to the maximum degree.

A neutral gray, when placed beside a positive color, apparently gains some of the complementary of that color; and the practical application of this simple demonstration is to be found in the employment of small quantities of positive, primary, or secondary color in conjunction with materials which either lack tone, or whose tone should be modified to some extent.

Interior stonework may be forced to assume a warmth which it does not really possess, by placing near it a mass of colder color, compelling it to partake in some degree of the warm complementary which is opposed to the cold color near it.

Corot's landscapes display a knowledge of this principle, where in a silvery-gray picture one little brilliant spot of red, possibly vermilion, is introduced in a peasant's cap or gown, and instantly the grays become greener by contrast, and the canvas fairly glistens and sparkles. Hide the spot of vermilion and you rob the entire picture of its life and brilliancy.

Delacroix, and, indeed, all the great colorists, play upon this theme, as a musician upon his keys,— from major to minor, and vice versa. And why should not the architect borrow color as well as harmony from those sister arts which so beautifully translate his own?

The employment of complementary contrasts in architectural work is so eminently valuable that it cannot fail to repay the most timid experiment; for we need great masses of quiet color, for grandeur is only possible through massive constructions; yet in and through the gray we may add the touch of color which shall "leaven the whole."

Puvis de Chavannes plays upon the complementaries in the Boston Public Library decorations, and sometimes the individual colors are separated by quite a space of gray. The rich yellow of the Sienna marble demands violet and blue for its completion as a satisfactory color impression, and the painter has carried out a scheme of this character in a wonderful way.

In one panel the pale blue sky at the top forms one point of a triangle, a dull red robe the second, and the yellow marble the third, while the eye of the beholder fuses these three into one harmonious impression.

As an illustration of this principle, certain stone, as Indiana limestone, acquires a decidedly greenish tone when associated with red brick, and the redder the brick, the greener the stone; but if a yellow brick be used in conjunction with the same stone, the latter becomes more purplish in tone. Again, if a purplish-red brick is employed, the yellow tone of the stone is strengthened in like degree.

Where brick is the only material used, it may be varied to any extent by using small quantities of an opposing tone, the kilns furnishing a wide range of yellows, reds, greens, and browns. In constructive color it will be found that large areas demand comparatively low tones of color, but as the areas decrease in size, the strength and brilliancy of color may be increased.

The same rule applies to interior work in marble, wood, or other materials, and the effect of any material may be enhanced or diminished by the judicious association with it of its complementary, or a stronger note of its own color.

A green bronze would be suggested as enrichment for a red marble like Numidian, but we should probably find a bluish patina preferable with the yellowish-red Verona.

The old brownish-red mahogany may be enriched by association with soft green carpets or hangings, but the lighter and yellower mahogany of to-day finds certain blues more agreeable and exciting companions.

Once the habit of *thinking* in color is formed, we find ourselves solving color problems instinctively; and if the attention of students is directed along this line of thought, their later work will show fewer examples of architectural aberration, for how rare are the entirely satisfactory efforts of our architects and painters.

In interiors of public buildings we find motives and orders which were always rendered in color during the best periods of architecture left in a sickly white, with a few lines of gilding as the only relief from inanity. Fancy St. Mark's or the *Capella Palatina* done in white stucco, with a few hair lines of gold carefully picked out in cornice or capital!

Their glory is in the color which bathes dome, wall, and column in golden light. They possess the tone which most of our buildings lack entirely, and which cannot be acquired by one or two tints ostentatiously covering the stucco with an even and wearisome monotone.

If mosaic was employed more generally in our buildings, we should the sooner achieve distinction therein, for it is one of the most satisfactory wall coverings obtainable. Mosaic is never monotonous; it is durable and fadeless, and, besides, it need not be inordinately expensive. There are two columns in the museum at Naples which are beautifully executed in mosaic, and it might be considered appropriate to thus sheathe the steel columns in our modern constructions, making beautiful and suitable enrichment rather than the usual painted plaster covering.

Referring to the use of applied color, we must consider that, as the greater part of our decorative painting must be executed on the wall, the questions of durability and permanence of color become all-important, and as dampness is probably the deadliest enemy of mural painting, it should be carefully excluded.

There is no preventive which compares with an air space between outer and inner walls; and as this means neither more nor less than ordinary furring of all walls and ceilings, it ought not to be as unusual as it now is to find absolutely dry and damp-proof walls, on which the mural painter may place his compositions.

Vitruvius gives an interesting account of the methods in vogue at Rome for the preparation of stucco wall surfaces for painting. Three coats of old slaked lime and sand were to be laid, and then three more coats with pounded white marble instead of the sand, each of these last more finely powdered than its predecessor, and the final coat to be polished until it reflected as a mirror!

Wax was then rubbed over the wall, and a brazier of coals was passed before it, warming the surface of the wall, and causing it to absorb the melted wax. Pigments, either ground in wax or some sort of mineral spirit were used upon this ground, and finally more wax was applied and absorbed, and the surface brought to a high polish. Many experiments have been made to discover some better or rather easier method of mural painting than the old fresco, which has so many disadvantages that it has been practically abandoned by all modern masters; and a modification of the Roman encaustic or hot wax method has been generally adopted by our most experienced men. The wall is prepared with dissolved wax, applied hot or cold, and the pigments are ground in a vehicle consisting of wax, spirits of turpentine, and either a resinous or balsamic "binder"; and as the colors dry quickly, thus permitting the painter to work over or change his composition within a few hours. The method is quite satisfactory for all general work of this character. It is hardly surpassed by the true fresco in brilliancy and not by it in durability, as portraits on wood from the Fayoum and the Pompeian wall paintings attest.

The latter may have been executed in fresco in part, but were usually finished with wax, and it is possible to detect the odor of the wax to this day, on rubbing the surface of the wall with the hand.

In concluding this brief survey of color in its application to architecture, it may not be considered inopportune to refer to the increased interest in mural painting in America, and to prophesy even a greater demand for this form of monumental art among us.

Our painters display, year by year, a higher appreciation of its possibilities, and our architects are giving more attention to its employment, and if the architects could be induced to study color, and the painters to study architecture, we might more confidently predict the triumph of American art.

ARCHITECTURAL RENDERING IN PEN AND INK.

BY D. A. GREGG.

HOW the drawing shall be treated as a whole is a question that should be settled before an ink line is drawn upon an outline submitted for rendering. It is considerable of an item to know how to give proper touch or technique to the work, to know a good line or method for doing the ground, sky, windows, walls, roofs; but failure may, after all, occur with all this skill, for want of knowing how to treat the work as a unit.

A rendering must be designed, studied out in a way, not unlike the designing of a building. As an architect often, by the shape of the lot, has the plan of the proposed building settled and fixed, from which he must erect the exterior design, so a draughtsman similarly has before him a perspective outline upon which he must build his scheme of rendering, which scheme of rendering may be called the general design; the technique of his work being, as it were, the detailing.

The design as a whole, in pictorial effect, is of first importance; the detailing secondary, but good quality in each are necessary for final success.

The rendering scheme is a matter of arrangement of values of black and white; and as every subject is unlike every other, only general principles can be given that will be of any practical use. It is useless to advise any special method for doing the various parts of the work, for what is best in this drawing may not do at all for another. Methods must vary, and effects or values must be moved about as the general scheme may demand.

A drawing may permit several good methods, but usually there is a best way for each particular piece of work.

All subjects should be treated in the largest possible way, broadly, as simply as possible, few effects, the fewer the better, just one if it will permit.

B illustrates this broad treatment. Viewed at a distance, it is like one dab of a brush upon a sheet of white paper. Just one large dark from end to end, from top to bottom. Compare it with E, where starting on the left is a dark, then follows a light, finishing with another dark, — three values instead of the one in B.

F is perhaps as broadly treated as B, as a large light effect. It would be fully as broadly treated if it were not for the value of the fence and the shadow near it. But this dark value is helpful, which goes to show that there are other things to be considered along with breadth, and no principle, however good, can always be carried out unaffected by other important demands.

This principle of breadth is modified and affected by the color of the material of which the building is made. For instance, a white marble building must appear white. Also to get color and contrast in such a drawing, dark buildings at the side are necessary, which introduce a second or third effect, instead of allowing it to remain as one.

Again, if we put one side of the building in shade, as in D, we have a light front and a dark side, — two values, or three, if we count the dark on the left. If foliage is to be shown, and usually it has a dark value, this will most likely make less simple the scheme of the drawing.

It is rarely, therefore, that a subject for rendering, especially if it be a large one, will allow so simple a treatment as B. For small work it is more often possible.

Nor is it necessary that every drawing should be as one dab of the brush. It should only be our aim to comply with its underlying principle of breadth as nearly as the conditions will permit.

A simple treatment is restful. We take it in without mental effort. Large effects are also impressive.

Allied with this broad treatment are certain minor advantages. Illustrators of architecture may assume the right to make their special building as interesting as possible. To make a view of a street is one thing, to make a view of one of the buildings on that street is another.

A may be rightfully called "A View on Steep Hill, Lincoln, Eng." Everything on the street is shown, sidewalks and the ground with its shadows.

B should have another title. "Old Houses on Steep Hill, Lincoln, Eng." In this one you are bound to look at the houses, for that is all there is to be seen, except the distant towers of the Cathedral. By thus omitting needless accessory the interest is centered in the principal object. In A you cannot but observe that the houses are slightly less attractive, because of the detracting interest of even the small amount of sidewalk and ground with its shadows.

Such a wholesale cutting off of accessory is, of course, not always best. In many instances the trees, terraces, and adjoining buildings add to the interest of the picture, in giving variety of form and contrast of color, and if they be rendered with a little less strength than the principal object the effect will be altogether helpful.

There are accessories important, and accessories not important, and this latter kind are best omitted.

Another advantage associated with the simple treatment in B is

one of black and white values. The white sky and ground produce a lively, snappy contrast with the dark of the buildings. The rendering of the buildings, having no competition in sky or ground, show off to their best advantage and fullest value.

D

The simplest thing to do, and it is sometimes the best, and surely always the easiest, is to omit texture entirely, and show shadows only, as in F. The only rendering here that is not a direct shadow is in the windows, but that is, after all, a shadow inside the building on the walls of a room. The necessary drawing of the fence has also the effect or value of a shadow.

This method of shadows only suits some subjects far better than it does this one, in which there is so little of projection or recess that can produce a shadow. Occasionally a building comes in hand for rendering that brings into itself so much color by shadow that more rendering in the way of showing texture or material is quite unnecessary. But it is rarely the case that texture can be altogether omitted. A little, at least, must be shown to properly tell the story.

F with texture omitted perhaps should be called a sketch only. It certainly could hardly be considered a thoroughly finished drawing. But sketches are sometimes as desirable as anything more thorough.

B shows a combined use of shadows and material color — mainly the latter. It is nearly an example of color of material only.

There is a danger connected with the making of a drawing like B which can be dodged somewhat by treating it as in C. The danger is, especially in larger work, of getting a heavy monotonous result through having too much rendering unbroken by fields of light. To show the roof white at once introduces light into the work. In the present instance it seems like using violence to do it, as the rough texture of the roof never would in sunlight permit a white reflection; but in many other instances where the roof is slated or shingled this white reflection is as often seen as not.

E

If you will observe on a sunny day the roofs of buildings and compare their color value with the blue sky, it may be surprising to observe that usually the roof appears the lighter of the two.

At another time of day, with the sun shining upon the roof at another angle, that same roof will appear almost black.

Another scheme which can easily be understood without illustration would be the reverse of C, the roofs dark and walls light, which is a very possible effect when the sun is low, reflecting from the walls, and not from the roofs.

In either case the rendering is simplified — a smaller field of half tone and a larger amount of light. The larger the amount of solid rendering, the more difficult becomes the work.

A drawing must not appear dull and heavy. A sunny, sparkling result should always be sought for.

When the area of rendering is large and close, so much the more need of a sweeping omission of accessory, that the white of sky and ground may relieve the monotony of gray or half tone. Therefore, scheme C or its reverse is a safer one, so far as values go, than B, because of less amount of half tone.

D is simply putting one side of the building in shade. It is not usually best to do this when the shade side is so conspicuously large. If we stood facing the front with a small, sharply vanishing side showing, such a scheme would be the most natural one. As a matter of values it is all right in this instance. But in the rendering of a building where both sides are equally valuable in design both sides should be about equally lighted. A sunlighted surface is always more interesting than one in shade.

E has about as much light in its make-up as D, but it is disposed in a different way. Both sides of the building are supposed to be in light, but the larger and clearest area of light is placed in the middle of the building. It is a possible natural effect, though a rare one. Such a treatment is not the one a camera would discover very often, but it might occur when the sunlight happened to get right of way through a rift in the clouds or the smoke of chimneys. Anyway, it is a method capable of beautiful, artistic effect, and is very often the best one to adopt.

F

Attention has thus been briefly called to the different treatments which this one subject could bear, which suggestions may be found useful to some of the readers of THE BRICKBUILDER, in work that may come under their hand. They are all based on possible natural effects of light, and shade, and color.

It should be clearly understood that all successful pictorial work is so because it appears natural. The architectural rendering that is the most like to a possible natural appearance is the best one. As all moral teachings can be tested by the standard of the Good Book, so all artistic attempts may be tried by their harmony or lack of it with nature's work in shade, shadow, and color, and correct form.

There need be no poverty in expression with such a varied and abundant store to draw from.

It is best not to heed too much what another learner has to say about these things, and so get them second hand, but go to the original source and learn for one's self. Nevertheless, hints like these I have given may do no harm if their worth is tested by thoughtful experiment.

Fire-proofing Department.

ORIGIN AND HISTORY OF HOLLOW TILE FIRE-PROOF FLOOR CONSTRUCTION.

BY PETER B. WIGHT.

(Continued.)

[In the April issue of THE BRICKBUILDER the last illustration, marked Fig. 17, was used by mistake, and will appear in the present number in its proper place as Fig. 19. The illustration of the first hollow-tile floor arch made by the Wight Fire-proofing Company, and used in the Montauk Block, Chicago, should be Fig. 17, and is here given.]

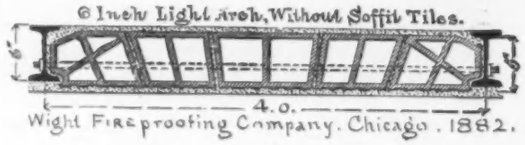


FIG. 17.

THE FIRST USE OF SOFFIT TILES FOR BEAM PROTECTION.

IT is necessary now to retrace our steps over a short space of time to the introduction of a feature which made the flat arch a complete fulfilment of the demand for a continuous fire-proof ceiling and protection for the iron beams as well as a support for the floor, independent of any construction over the beams. Up to 1884, all the flat arches that had been built were practically in the Roux system, and varied from it only in matters of detail. The beams had no protection to the bottom flanges except a plate of cement or common mortar not more than three quarters of an inch thick, gaining support from the slightly dovetailed form of the skew-back tiles. After they were plastered over, in course of time, whether the ceilings were painted or not, the location of the beams could be seen by streaks on the ceilings, and this was especially the case in locations where bituminous coal was used. In 1883, I conceived the idea that the beams could be covered with a shoe of tile on the bottom before setting the arches, and that this shoe could be held temporarily in place by giving the upper side the form of a female dovetail, and filling the joint between the beam and tile with mortar. The whole thing would thus form an extension to the bottom flange of the beam, and the skew-back tile could be made of such form as to surround its edges so that the bottom of the arch would be flush with the bottom of the shoe tile. I patented this invention in 1883, showing its connection with a 9 in. flat webbed arch, an illustration of which is here given (Fig. 18) showing its connection with a 12 in. arch.

FIG. 18.

FIG. 19.

FIG. 20.

These soffit tiles were first used in the main building of the Mutual Life Insurance Company, of New York, on Nassau Street, and that is the first time I believe they were ever used in any building. From then to the close of operations of the Wight Fire-proofing Company, in 1891, they were used with every floor arch built by that company, with only one exception. The holder of the Johnson and Kreischer patent, above described (Fig. 13), brought suit against the Mutual Life Insurance Company for infringement of patent. The judgment was given in his favor except in so far as the use of mortar was concerned, his patent having claimed that the strip was "removable," and not specifying the use of mortar to hold it firmly. It was shown that such a tile had never been actually used in floor construction, in fact, was impracticable under the former patent; consequently the court refused to award damages. I have, therefore, only the satisfaction of knowing that I demonstrated what is practicable in it and have given it to the world. The same plaintiff had previously brought suit against Henry Maurer for infringement of the Balthazar Kreischer patent (Fig. 14), but a verdict was given for the defendant, the main references being the Garcin and Roux patents. In practise it was soon found that it was not necessary to cement the soffit tiles to the beams, but that they could be held in place by the centering until the skew-backs were set in place, and that the bedding of the skew-back filled not only the joint between itself and the soffit tile, but also the joint between the soffit tile and the beam. In places where the arches are removed it is found that the soffit tiles adhere to the beams.

The work on the Mutual Insurance Building was hardly done when others began to use a similar tile under the beam. The first instance that I know of was in the Stillman Apartment House at Cleveland, Ohio, built in 1884–85. There, as in all other cases of work done by imitators, the cheaper method of putting a tile under the beam only the width of its bottom flange was used (Fig. 19.) Here it will be seen that the support from the skew-back is only half as great as where the soffit tile is also dovetailed at the top. The only variation I ever made from this method was in the case of the Phœnix (now Western Union) Building, Chicago, where the bottoms of the arches were 3 ins. below the beams, and the soffit tiles were made as complete hollow tiles. The arches were 10 ins., having 7 ins. rise above the bottoms of the beams. The flat soffit tile, with a slight recess on the top to afford an air space, is still generally employed by all contractors for beam protection, with various kinds of arches. Some other methods were tried, but have gone out of use. Henry Maurer, of New York, still makes a skew-back with an arm extending half way across the bottom of the beam, having a small hollow space. Fig. 20 shows the ordinary method of protecting the bottoms of the beams as used by the Pioneer Fire-proof Construction Company, of Chicago, when side pressure hard tiles are employed. The arch tiles are 10 ins. deep.

INTRODUCTION OF THE END PRESSURE SYSTEM.

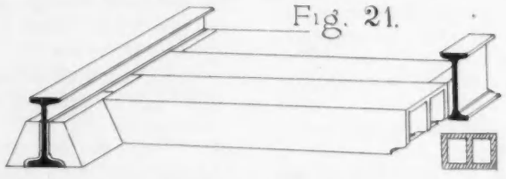
It was not until 1890 that any advance had been made in the construction of hollow-tile floor arches over the methods used in New York, of which Maurer's was a good example, and those of the Wight Fire-proofing Company and Pioneer Fire-proof Construction Company, of Chicago. A great deal of work had been done by others which resembled these methods, and side-pressure porous tile arches had been made and used in several buildings in Kansas City as well as Chicago. Those used in Chicago were made of a light brick clay from Lake Calumet, with an admixture of a small quantity of fire-clay from Brazil, Ind. The Kansas City material was made of the very inferior loamy red clay of which the hills of that city are composed, and was about the worst material from which porous terra-cotta could be made, both for constructive and fire-resisting purposes. Its use also involved the manufacturers in great loss from breakage in the course of handling and setting. Mr. Thomas A. Lee was

then the superintendent and engineer of the Kansas City Company. When he obtained the contract for fire-proofing the United States Government Building at Denver, he determined to use a white semi-fire-clay from Hobart, Ind., not far from Chicago, for the manufacture of his porous terra-cotta, this having been used successfully for side-pressure floor arch blocks at Chicago in the Metropole Hotel. But instead of using side-pressure voussoirs, he made all the tiles from one die, the section being a square of 9 by 9 ins. with cross webs in both directions. The tiles had four square holes, and the thickness of all the walls and webs was about 1 in. These were cut, before drying and burning, into skew-backs and voussoirs, and were set in courses from beam to beam, so that no joints were broken; but in all cases four joints would come together at one point. These, I believe, were the first end-pressure arches ever set in a building, and the same method, but with tiles of a different cross section, was used by him in the Broadway Theater Building at Denver. I have always thought, though I am not certain, that Mr. Lee determined to set his porous tile arches in this way at Denver on account of the difficulties that he encountered with the use of inferior porous terra-cotta at Kansas City. In any case, I think that he is entitled to the credit of having first used end-pressure arches successfully in an entire building. But the Kansas City Company had been working under patents of the International Terra-Cotta Lumber Company, which had already experimented with arches made by taking a long piece of rectangular porous terra-cotta, cutting it into voussoirs and setting them together in a flat arch.

The principle of the end-pressure arch had, however, been patented long before this. In addition to the use of end-pressure tiles for segment arches, as heretofore described as invented by Joseph Bunnett in 1858, a patent was issued in this country to Leonard F. Beckwith, of New York, for an end-pressure flat hollow arch in two pieces, in 1879.

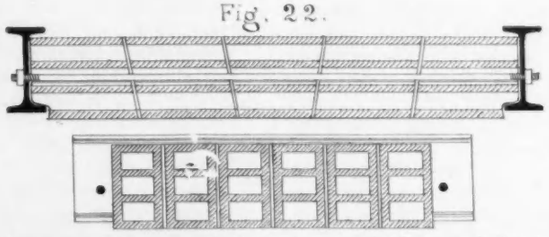
I reproduce an illustration of this system from the *Patent Office Gazette* (Fig. 21).

Fig. 21.



L. F Beckwith's Patent End Pressure Arch. 1879

Fig. 22.



Cross and Longitudinal Sections of Thomas A. Lee's End Pressure Porous Terra-Cotta Arch, Tested at Denver, December 1890.

Mr. Beckwith made his arch in two pieces, using one long hollow tile and one solid skew-back. The end of the hollow tile resting on the beam was cut to fit it, and the other end was beveled to fit the skew-back, which also had the shape of the beam on its bearing side. He alternated the position of the skew-back at every other course, but each course was an independent structure as now used in all end-pressure arches.

I have never seen these arches put into practical use. This was not even the earliest patent touching the principle of the end-pressure arch. In 1875, a patent was issued to Levi T. Scofield, of Cleveland, O., for hollow floor arch tiles between I beams all in one piece. They were shown to be either flat or in segment form, and of many different sections, but in all, the holes ran from beam to beam.

On account of the difficulty in burning long tiles this system was never used to any extent for floors, but where ⊥ irons were used not more than two feet from centers, a similar tile came in use, which was called "book tile," on account of its having the outer section of a book, so as to lock the tiles together. Mr. Scofield's patent did not cover the tongue and groove shape at the edges, and book tiles were never patented, but were extensively used long before end-pressure arches made of voussoirs.

THE DENVER TESTS.

The general adoption of end-pressure arches is very recent, and followed soon after the extensive tests made by Andrews, Jaques & Rantoul, architects, before the erection of the Equitable Building at Denver. These tests have been described and commented upon in THE BRICKBUILDER (January and February, 1895,) by Mr. George Hill. They were suggested by Mr. Thomas A. Lee, who had bid for the fire-proof work on the building in competition with the two best-known fire-proofing companies of Chicago, and was the highest bidder. His tender was for porous terra-cotta floor arches, and his samples were made at Hobart, Ind., where, I believe, most of the material for the building was subsequently manufactured. He challenged the other two bidders, both of whom made side-pressure arches of dense fire-clay for strength of material, and fire-proof qualities. A section of his sample arch which was subjected to all the tests is here given (Fig. 22).

The tests for strength on all the arches were for dead weight and smashing. Those for fire resistance were for a continuous fire until destroyed, and for fire alternating with water until destroyed. It is needless to say that these were crucial tests, and it should be added that they were conducted with perfect fairness to all parties. They demonstrated the superiority of Mr. Lee's material and construction to the others in every case, and yet the published results were calculated to be very misleading to architects and the users of hollow tile floor construction who did not study the reports carefully. I entirely agree with the criticisms of Mr. Hill. But it should be added that the publication of such tests without comments, especially when they were tests to the point of destruction in all cases, is calculated to convey the erroneous impression that the two systems most easily destroyed were worthless, and the survivor the only good one. As a matter of fact, the only tests that demonstrated anything useful were the still-load tests for strength and the heat tests during the first three hours. In the still-load test the arch of the Wight Fire-proofing Company broke at exactly 1,000 lbs. per superficial foot, adding the weight of sand and box to that of the pig iron, while the report was so drawn as to imply that the weight was only from the pig iron. This is exactly the extreme weight they were guaranteed to carry, and to which they had been repeatedly tested in floors of buildings. The Pioneer Arch broke at 651 lbs. per superficial foot, but it was admitted that the sample was defective and not up to the standard of their work. So, also, with the heat tests. That for continuous fire lasted twenty-four hours in each case, and there was no way of making a record of the condition of the samples after three hours, which is about as long as they would ever have to last in any building. As for smashing tests, all kinds of material are continuously being tested by falling bodies in new buildings, and it is well known how they are affected.

The tests demonstrated that porous tiles were more fire-proof than hollow tiles, and that end-pressure arches are stronger under the same conditions than side-pressure arches, but did not demonstrate that hollow fire-clay tiles would not stop the progress of an actual fire, nor that side-pressure arches, as usually made, were not strong enough for practical use in all classes of floors.

(*To be continued.*)

Mortar and Concrete.

AMERICAN CEMENT.

BY URIAH CUMMINGS.

CHAPTER VII.—(*Continued.*)

CEMENT TESTING.

HENRY REID, in his work on "Portland Cement," London, 1877, page 315, says: "The presence of free lime thus unconverted is now frequently due to an over-dose of carbonate of lime in the cement mixture to enable it to pass successfully the modern onerous tests."

From that time until to-day the demand for higher tests has been continuous and more burdensome, and the manufacturer has not scrupled to employ any and every means within his power to accomplish the required results. He has to do it or retire from the field.

And thus, by an unfortunate misinterpretation of the readings of the tensile strain-testing machine, in the early days of its existence, the opinions then formed have passed current as sound and unquestioned through all the subsequent years.

So strong and deep seated is the belief to-day in the reliability of the testing machine, that a person who cares to be considered as "up to date" must express no doubt as to its infallibility.

An ideal hydraulic cement, as already stated, can be produced by what is known as the Portland process.

It would consist in a selection of the raw materials which were found to be best adapted for the purpose (special care being taken, at least, as to the quality of the clay), and these to be thoroughly and finely commingled in correct proportions, then calcined to a mild clinker, sufficiently vitrified to produce the desired weight, and then ground exceedingly fine.

Such a cement would test only about half as high as the present so-called Portlands, yet it would be an ideal cement.

It could not be excelled, and could be equaled only by a rock cement having its constituent parts present in exact chemical proportions.

It is only through the engineer that any improvement may be expected. He alone is entitled to the doubtful distinction of bringing about the change from the slow-setting pasty Portlands of twenty-five or thirty years ago to the harsh, high short-time testing Portlands of to-day.

It is neither pertinent nor sound to reason that, because the Portlands used twenty-five or more years ago may be in good condition to-day, the Portlands of the present are worthy of the utmost confidence, for every person at all conversant with the facts knows that those earlier Portland cements tested but about half as high in one, seven, thirty, and ninety day tests as do the Portlands now on the market.

If an artificial cement of a pasty consistency should test 80 lbs. in one day, and 175 lbs. at seven days, 300 lbs. at six months, 600 lbs. at one year, 1,000 lbs. at two years, and 1,200 lbs. at five years, and should be found at that age to be tough and stone-like in its character, can any one for a moment doubt that such a cement would be infinitely superior to the harsh, high short-time testing cements of to-day?

Is it not worth while to reflect that for every one year that harsh cements have been in use, those of a pasty character have been in use fifty years?

Is it difficult to understand that it is only the pasty cements that eventually assume a stone-like character, while those that are harsh inevitably become glassy?

It is well known to every manufacturer that the latter class is much more expensive to produce, but the manufacturer has no alternative. He must produce such grades of cement as the engineers demand.

It is to the engineers, therefore, as has already been stated, that any improvement may be looked for, and the only improvement needed, with respect to artificial cements, is to get back to the sensible Portlands of thirty years ago.

Let the engineer stipulate that cements shall not test below or above certain fixed limits, and there will be an end to this doctoring and drugging of the artificial cements, which is resorted to simply and solely for the purpose of meeting arbitrary and unreasonable requirements.

The following table of tests of English Portland Cements by Reginald Empson Middleton, M. Inst. C. E., was printed in *Engineer*, London, Vol. 65, p. 279, April 6, 1888.

The figures given represent the average strength in pounds per square inch, in tensile strain, and the ages in days of the briquettes when broken.

No.	Days.	Pounds.	Days.	Pounds.	Days.	Pounds.	Per cent. of Loss or Gain.	
1	7	258	942	440	1325	550	Gain.	115.
2	7	320	900	635	1283	577	Gain.	75.
3	7	371	982	560	1365	599	Gain.	61.
4	7	419	1040	415	1423	492	Gain.	18.
5	7	479	1088	542	1471	551	Gain.	15.
6	7	534	858	545	1241	526	Loss.	1.5

This table discloses the fact that artificial cements which at seven days test from 250 to 350 lbs. show higher ultimate results than those which at seven days test 400 to 600 lbs.

The following quotation from the "Transactions of the German Association of Cement Makers" discloses either a deplorable lack of common honesty or a desperate attempt at fulfilling the severe requirements of engineers. "In order to obtain the best results (?) the amount of plaster of Paris used must be proportionately increased in accordance with the quantity of ground slag employed." Presuming it to be a case of necessity rather than a lack of common honesty, what a commentary on the straits to which the producers are reduced to meet the requirements of engineers, knowing, as all manufacturers do know, that plaster of Paris is in no sense hydraulic, although it tests neat as high as 250 lbs. per square inch in tensile strain in twenty-four hours.

The time must surely come when it will be well understood that any and all schemes of hot-house forcing, for the purpose of obtaining high seven-day tests, constitute an unnatural interference with the crystallization of true silicates, and are therefore a serious damage to their most desirable qualities of endurance.

Verily it is the pace that kills, and even when applied to hydraulic cements, there is, if we may be permitted to employ it, no truer saying than "Soon ripe, soon rotten."

For hydraulic purposes there is no known substance that can in any way aid or improve the quality of pure unadulterated hydraulic silicates, when left to crystallize in their own natural way.

THE BOILING TEST.

During the past few years it has become quite the fashion to boil samples of cement in order to test their qualities.

If one brand sustains the test without serious results it is considered superior to others which fall down during the boiling. This is about as wise and logical a conclusion as that arrived at by some of our good old Puritan fathers during the witchcraft craze.

The witch, being thrown into a pond, if she went to the bottom and stayed there, was considered innocent. But if she managed to float, she was deemed to be possessed of the devil, and was then forced to the bottom on general principles.

By the boiling test, many of our very best brands of cement are condemned.

It is safe to assert that of the more than one hundred and fifty million barrels of American Rock cements used in all the great en-

gineering works throughout the country during the past fifty years, and with no evidences of failure, not 1 per cent. would have sustained the boiling test.

A cement, whether natural or artificial, that will crystallize so rapidly as to sustain the boiling test, ought to be looked upon with suspicion, as it is either naturally too quick setting, or is too fresh and lacking in proper seasoning.

FREEZING TEST.

The many experiments that have been made by different authorities in the freezing of green cement samples would seem to indicate that Portland cement mortar will sustain severe freezing without appreciable disturbance of the exposed surfaces, but it suffers in loss of strength in some cases as much as 50 per cent.

While the Rock cement mortars will show disintegration to the extent of ¼ to ½ in. on the exposed surfaces, yet the portions not disintegrated are shown to have sustained no loss in strength, and in some instances the strength is above the normal.

A series of tests made by the author, the results of which are herewith tabulated, differ somewhat from those of other writers, resulting, no doubt, from having experimented with different brands of cement.

All of the briquettes were given one day in air and six days in water, those in the second column being placed in water and set outside, where they were soon frozen, and so remained in solid ice, until thawed out and broken at the end of the seventh day.

All of the briquettes represented in the second column, after being thawed out, were shown to have lost equally in area, by scale and disintegration to the depth of ⅛ in. on all sides.

There was no appreciable difference in the losses, the Portlands having suffered equally, in that respect, with the Rock cements.

The figures in the second column show the actual breaking strain of the frozen briquettes, but it will be borne in mind that the areas of these briquettes were greatly lessened by freezing; therefore the percentage of loss in strength, as shown in the third column, represents the loss without regard to actual areas.

The fourth column represents the strength of the samples in the second column when calculated at 1 full square inch, or equal in area to the samples in the first colunm.

The fifth column represents gain or loss in strength of the frozen samples, with equal areas of the unfrozen ones.

All of the briquettes were gauged neat by the same person, and were treated alike as to plasticity and temperature.

TABLE OF TESTS OF THE RELATIVE STRENGTH OF FROZEN AND UNFROZEN SAMPLES OF THE SAME CEMENT.

No. of Column.	1	2	3	4	5	
Kinds of Cement.	Not Frozen.	Frozen.	Per cent. of loss by freezing.	Per square inch of the frozen samples.	Per cent. of loss or gain by freezing, of equal areas.	
Medium Burned Rock Cement.	138	135	2.17	194	Gain.	40
Hard Burned Rock Cement.	226	225	0.44	323	Gain.	43
Slow Setting Portland.	388	280	27.83	402	Gain.	04
Medium Setting Portland.	419	292	30.31	419	Gain.	00
Quick Setting Portland.	433	255	41.11	366	Loss.	15

There is a surprising gain in strength of the Rock cements by freezing.

With the Portlands, the slow and medium setting samples held their own, while the higher testing Portland, under ordinary rules, lost 15 per cent. in strength of equal areas by freezing.

It is not good practise to use any kind of cement in cold weather, especially when it freezes during the night and thaws during the day, and should be avoided whenever possible.

NOTE.— Mr. Cummings's series on American Cements will be concluded in the July number of THE BRICKBUILDER.

LIME, HYDRAULIC CEMENT, MORTAR, AND CONCRETE. III.

BY CLIFFORD RICHARDSON.

LIME MORTAR.

MORTAR is a mixture of some cementing material with sand. Lime mortar is composed of lime paste and sand, with the addition, for certain parts of plastering, of hair and similar bonding material.

NECESSITY OF SAND IN MORTAR. — Good cream of lime might be used alone as cement, as it hardens on exposure to the air by drying, were it not that, under these conditions, it shrinks and cracks very badly. It is, therefore, customary, both on this account and for economy, to temper it with sand. This should be clean, sharp, and rather coarse for masonry, finer for plastering. When discussing hydraulic mortars and concretes there will be occasion for a further consideration of sand and its qualities and proper use.

PROPORTION OF SAND TO LIME. — A mortar made of lime paste should, theoretically, contain so much sand that the cream of lime will more than fill the voids, that is to say, the volume of the mortar should be greater than that of the sand. In fact it is necessary that it should considerably more than fill them in order to thoroughly coat each particle and provide for shrinkage. If too much sand is present there is not sufficient cementing material to make a firm bond, while on the other hand, if there is too little the mortar will tend to shrink and crack on drying. If too little lime is used the deficiency must be made up with water, that is to say, the paste is made very thin.

In ordinary sands the voids are from 30 to 40 per cent. of the volume of the sand. With sand, having 40 per cent., such as that which is used for the best lime mortar, 1 volume of paste would fill the voids in 2.5 volumes of sand with no excess. As a matter of fact, practice leads to the addition of only from 1.25 to 2 volumes of sand to 1 of paste which, when the caustic lime yields 2.5 volumes of paste, means 3 to 5 volumes of sand to 1 measured volume of caustic lime. In this way a plastic mortar and one that will not crack in drying is made. With fat lime and sharp sand 3 volumes of sand to 1 of lime forms a rich mortar and these proportions are often required in the best specifications. The greater part of the mortar used in ordinary brickwork is, however, made with 5 volumes of sand, or more, and is probably satisfactory.

Illustrating the results of the variation in the proportions of lime, water, and sand in mortars, the following original experiments have been made: —

MORTAR EXPERIMENTS.

Composition and Physical Properties of the Caustic Lime.

Loss on ignition, water, etc.	1.0
Insoluble silica and silicates	1.2
Alumina and iron oxide	.8
Magnesia	.6
Lime	95.6
	99.2
Volume weight of a cubic foot including voids	60 lbs.
Voids	44%
Density of lump	1.52

No. of Experiment.	1	2	3	4	5
Weight of lime used	1,000	1,000	1,000	1,000	1,000
Weight of water to slake	1,000	2,000	2,500	3,000	4,000
Weight of water for paste	1,000	500	none	none	none
Volume of water to one of lime	2.	2.5	2.5	3.	4.
Volume of paste	2,000	2,560	2,712	3,120	4,120
Weight of paste	2,720	3,280	3,392	3,880	4,850
Density of paste	1.36	1.28	1.25	1.24	1.17
Characteristics of Paste	Thick	Thick	Medium	Thin	Very thin
Volume of sand, moist	2,000	3,000	5,000	7,100	14,360
Weight of sand	3,000	4,500	7,500	10,080	20,600
Volume of sand to lime	2.	3.	5.	7.1	14.4
Volume of sand to paste	1.	1.2	1.8	2.6	3.5
Volume of mortar	3,320	4,400	5,840	7,200	13,500
Weight of mortar	5,740	7,760	10,650	13,960	25,450
Density of mortar	1.73	1.75	1.82	1.94	1.88
Consistency of mortar	Thick	Medium	Medium	Sloppy	Very sloppy
Dries	Cracks	Dries without shrinking.			

PERCENTAGE COMPOSITION.

Water	30.0	29.3	22.5	20.7	15.1
Sand	51.6	67.9	68.1	72.2	82.0
Lime	17.4	12.8	9.4	7.1	3.9
	100.0	100.0	100.0	100.0	100.0
Relation of water to lime	1.7	2.3	2.4	2.9	3.9

COMPOSITION OF DRY MORTARS.

No. of experiment.	1	2	3	4	5
Water of hydration	7.4	4.8	3.7	2.8	1.5
Sand	70.0	81.1	84.6	88.5	95.0
Lime	22.6	15.1	11.7	8.7	4.5
Weight per cubic foot dry, lbs.	98.	99.	101.	108.	111.
Tensile strength, lbs. per sq. in. when dry	40–16.	36.	38.	40.	30.
Crushing strength, lbs. per sq. in. when dry	95			97	85

The experiments, it will be noticed, were carried out with a pure and fat lime. The sand in use was not very coarse, and had 40 per cent. of voids. From the results the following conclusions may be drawn: —

SLAKING. — Slaking with a volume of water equal to the measured volume of the lime, with 44 per cent. of voids, or with a weight of water equal to the weight of the lime, gives a volume of paste, after the addition of another volume of water, equal to that of the water used, only. This paste is very thick.

Slaking with two volumes of water, with the addition of half a volume, after slaking is finished, making 2.5 volumes of water in the paste, gives 2.56 volumes of paste which is thick and rich.

Slaking with 2.5 volumes of water added all at once gives 2.71 volumes of thick paste suitable for good mortar.

Slaking with 3. volumes of water added at once gives 3.12 volumes *of* thin paste.

Slaking with 4. volumes in the same way yields 4.12 volumes which is too thin to be of value.

It appears, then, that slaking with 2.5 volumes of water added at once is the most advantageous method of procedure, and that but a small departure from these proportions on either side will result in forming a less satisfactory paste.

Of course with poorer limes much smaller volumes of water should be used.

DENSITY. — The density of the paste naturally decreases with the increase of water it contains.

VOLUME OF SAND FOR MORTAR. — If but twice the volume of the lime is added to the paste in the form of sand, the resulting mortar is too rich. It contracts and cracks on drying. Three volumes of sand make a very rich and satisfactory mortar such as should be used for laying up fronts and pointing. Five volumes form a mortar good enough for ordinary brick masonry where not exposed to moisture, while greater amounts of sand furnish mortars which are very porous, but serve for cheap work in absolutely dry situations.

DENSITY OF THE MORTARS. — The density of these mortars is, of course, proportionate to the amount of sand they contain. Their porosity is larger the more water the paste contains.

VOLUME OF MORTARS. — With a small amount of sand the volume of the mortar is, where twice the volume of the lime is sand, 66 per cent. more than the volume of the sand; where the volumes of the sand is three times the lime, 46 per cent. more; where 5 volumes, 17 per cent.; with 7 volumes the mortar is less in volume than that of the damp sand owing to its closer compaction.

The amount of water in the paste plays a prominent part in the relation of the volume of mortar to the volume of sand and to the amount of sand which can be added to any paste.

COMPOSITION OF WET MORTARS. — Calculation shows that these varied mortars contain from 30 to 15 per cent. by weight of water or from 17 to 3.9 per cent. of lime, but the relation of water to lime increases with diminution of the amount of lime, that is to say, with the increase of sand, from 1.7 in the richest mortar to 3.9 times as much water as lime in the poorest mortar with the thinnest cream. These figures show why the richest mortar contracts the most on drying from loss of the largest amount of water, and that the poorest mortars, although not having as large a per cent. by weight of water still have not enough lime to form proper cement.

COMPOSITION OF DRY MORTAR. — The dry mortars contain from 22.6 to 4.5 per cent. of lime, but as the two extremes of combination would never be used in practice, it appears that mortars as ordinarily mixed may contain from 15 to 8 per cent. of lime. This corresponds to the results obtained by analysis of many mortars actually employed in masonry.

STRENGTH OF DRY MORTAR. — The set of mortars acquired by simply drying out gives them a tensile strength of from thirty to forty pounds per section of 1 sq. in., and a crushing strength of about 85 to 95 in 2 in. sq. section. There is not such a difference between the different kinds of mortars at this stage, but with age there would be but little increase in strength with the poorer ones. The physical properties of the latter are also against them as they cannot resist moisture.

Professor Smith's tests, given in the January number of THE BRICKBUILDER, show also that with a diminution in the cross section of the mortar there is an increase in the strength per square inch of section. This is due to the liability of shrinkage cracks in tests pieces made with larger cross sections.

GENERAL CONCLUSIONS. — It appears that fat limes should be slaked with 2.5 volumes of water, added at once in a closed box, to obtain the best and largest amount of good paste; that with this, three times the volume of the lime in the shape of moist sand may be mixed for fine work, such as pointing, plastering, and in places exposed to dampness, and that 5 volumes of sand is not too much for ordinary brickwork.

The amount of mortar which a barrel of lime, of average weight, under the same conditions as in the experiments, would yield is,

Parts sand	Parts water	Cubic feet.
3	2.5	16.5
4	2.5	20.6
5	2.5	24.8

or, 4 cu. ft. of lime with 2.5 parts water, and 4 volumes of sand would yield 22 cu. ft. of mortar, which, according to authorities, is sufficient to lay one thousand brick in ordinary brickwork with coarsely drawn joints. With more compact work one barrel of lime will lay one thousand bricks. A barrel of poor or magnesian lime will not yield more than three quarters of these quantities.

AMENDMENTS TO LIME MORTAR.

Lime mortar, made of ordinary rich lime, is not suited for masonry where it is exposed to water, dampness, or to the absorption of water by capillarity from the soil. The hardest lime mortar will absorb 15 to 25 per cent. of its volume of water. If hydraulic cement cannot be substituted for it, on the score of economy, a certain degree of improvement may be made in the mortar by mixing it with finely ground brick-dust or burnt clay, which yield the necessary silica to make it somewhat hydraulic and less porous; or a certain portion of the lime, one third, for instance, may be replaced by hydraulic cement.

This is seldom done, as it is cheaper in the end to use cement alone.

EFFECT OF FROST ON LIME MORTAR. — The most thorough experiments of Tetmaier show that lime mortar cannot be used at temperatures below freezing, especially with porous materials, and attain any bond. No additions, such as salt, soda, glycerine, or sugar will prevent lime mortar, when frozen for any length of time, from becoming a friable material.

MIXING MORTAR.

Mortar can be mixed by hand or machinery. The latter is of course preferable. When done by hand, as is the common custom, the operation should be carried on in a closed box, or on a surface through which water cannot escape, and with suitable walls of sand. Machine mixing is much more thorough than that done by hand, and is coming into vogue rapidly in our larger cities where there is such a use of mortar as to make it an economy to prepare it on a large scale. Such mortar is more regular in composition than hand made. All the material can be accurately gauged and weighed, which is most desirable.

SETTING OF LIME MORTAR.

The setting of lime mortar is the result of three distinct processes which, however, may all go on more or less simultaneously. First, it dries out and becomes firm. Second, during this operation, the calcic hydrate, which is in solution in the water of which the mortar is made, crystallizes and binds the mass together. Hydrate of lime is soluble in 831 parts of water at 78 degs. F.; in 759 parts at 32 degs., and in 1136 parts at 140 degs. Third, as the per cent. of water in the mortar is reduced and reaches 5 per cent., carbonic acid begins to be absorbed from the atmosphere. If the mortar contains more than 5 per cent. this absorption does not go on. While the mortar contains as much as 0.7 per cent. the absorption continues. The resulting carbonate probably unites with the hydrate of lime to form a subcarbonate, which causes the mortar to attain a harder set, and this may finally be converted to carbonate. The mere drying out of mortar, our tests have shown, is sufficient to enable it to resist the pressure of masonry, while the further setting furnishes the necessary bond.

There is also supposed to be a formation of lime silicate in the course of setting. The evidence in favor of this has been obtained by German investigators from the analyses of very old mortars. Some of these analyses have been collected by Feichtinger, and are of interest.

	1	2	3	4	5	6	7
Lime	23.52	17.40	18.26	45.70	13.27	22.02	14.42
Magnesia	8.50	9.92	5.06	1.00	0.86	1.33	0.04
Carbonic Acid	16.24	10.30	18.94	37.00	11.31	19.59	11.37
Silica, Soluble	10.40	3.98	1.11	——	trace	0.22	0.40
Alumina	2.56	3.42	1.90	2.64	1.72	1.90	trace
Iron Oxide	1.56	4.25	1.90	0.92	1.72	1.90	trace
Water	4.48	5.49	3.31	0.36	2.34	3.05	0.92
Sand	32.50	43.30	51.52	12.06	70.50	51.89	72.50
	99.76	100.06	100.00	99.68	100.00	100.00	99.80
Carbonic Acid calculated from lime and magnesia	27.83	23.68	20.3	37.00	11.36	18.74	11.37

1. Mortar from Vienna, 662 years old.
2. " " " 303 " "
3. " " " 50 " "
4. Athenian Mortar, classical times.
5. Munich " recent.
6. " " "
7. Old Roman, Yarmouth, England.

It appears more plausible that the soluble silica found in these mortars was derived from silica contained in the limestone from which the lime was derived, and which was rendered soluble in the process of burning by combining with lime, than that it was due to any combination of the lime of the mortar with the silica of the hard quartz grains of sand, which seems highly improbable. In these old mortars the amount of carbonic acid is high, and in several cases it is sufficient in amount to have converted the lime and magnesia completely to carbonate, although the percentage of these bases is in most cases much greater than good practice demands.

The Masons' Department.

THE ARCHITECT AND CONTRACTOR.

BY THOMAS A. FOX.

IN CONCLUSION.

IN closing this series of articles which have been intended to show briefly the relations, both as they are and as they should be, between the architect and contractor, it is desirable to emphasize the fact, to which allusion has already been made, that the way to overcome much of the friction and many of the misunderstandings which now exist is to bring about more intimate relations between the representative organizations of the architects and the builders. In almost every city of any considerable size throughout the country we now find a local society of architects, usually a chapter of the American Institute and a Master Builders' Association, generally connected with the national organization. While these two parent bodies have considered, from time to time, various matters of mutual interest, and have conjointly framed and issued the uniform contract which has done more than any other one thing to bring about harmonious practice in this important particular, at the same time there are many matters of detail in which local customs figure to such an extent that action by the national bodies is undesirable, which could be easily adjusted by conferences between the local organizations. There is little doubt that, under ordinary conditions, the average architect considers the average contractor a more or less unprincipled individual, who selfishly guards his own personal interests at the expense of every one else, and it is also true that this feeling is reciprocal on the part of the builder. But this condition of things fortunately exists only when the parties, as the saying is, deal with each other at arm's length. Let a body of men, representing the architects and builders, sit around a table and discuss, in a liberal and broad-minded way, the matters which have been the result of innumerable controversies and more or less hard feeling in the past, and each would be surprised to find how quickly and satisfactorily many of the contested points could be settled. The Boston Society of Architects, which justly prides itself as being one of the leaders in its sphere on such matters, at a recent meeting ordered its executive committee to meet the representatives of the Master Builders' Association, to consider in general the matters of mutual interest to both bodies. While it is too soon to predict in detail what the outcome of such a conference will be, it is safe to say that this action promises to be the entering wedge which may lead, eventually, to an agreement which will correct at least some of the abuses which exist on each side. Reforms usually commence from without, that is to say, while the architects on the one hand, and the builders on the other, may be aware that certain improper practises exist, there will be little hope of their being corrected until attention is called to them, and possibly some pressure brought to bear by those who suffer from the present condition of affairs; and the simplest and easiest way to accomplish the desired result is to bring the interested parties face to face, where they may listen to a frank discussion of the matter at hand. For those who have made a study of these questions it cannot be claimed that this series of articles has presented any new facts or suggestions, for such has not been the intention; the object in writing on the relations between architect and contractor has been simply to point out the fact that there is at the present time more or less friction between these two allied interests; that while much of the trouble is due to unavoidable conditions, under which much of the work is undertaken and carried out, yet at the same time many of the abuses are such that they could be corrected by the intelligent and united action of the architects on the one hand, and the builders on the other. The means for accomplishing such a result are at hand in the societies of architects and associations of builders, all that is necessary being to bring the representatives of each together; and if

this can be accomplished, as it already promises to be, we shall, no doubt, see in the near future the same improvement in the ethics between these two organizations as we have witnessed within individual associations themselves.

BRICK JOINTS.

THROUGH the efforts of the architects and manufacturers the brick industry has, of late years, shown a wonderful development, for it is but a comparatively short time since there was practically but one shape and color, and the only variation to be had was in the different degrees of finish. During the period when the pressed brick was in favor, it was unquestionably the desire of both the architect and the mason to avoid, so far as possible, all appearance of texture in a face wall; the bricks were made as smooth and regular as possible. They were bonded with "cut" headers, so as not to disturb the regularity of the courses, and the joints were made as fine and narrow as was possible, one of the essential qualifications of a first-class face brick layer being the ability to make the joints as narrow and inconspicuous as possible. Such work was at first laid in common mortar, made with fine sand, which allowed the bricks to be laid very close, but later the desire to have the joint still less prominent led to the practise of putting such coloring matter in the mortar as would bring it to the same tone as the brick. This practically obliterated the joint, and made a wall of a smooth, slippery, and, as it has sometimes been called, "licked" surface.

This kind of masonry necessarily lacked two essentials of most good architecture,— texture, and a straightforward recognition of the materials employed and the method of using them. Now, the construction of a brick wall naturally consists in laying courses of bricks one on top of the other, with a layer of mortar between each one, and it is consequently apparent that if we are to use our materials honestly, the joint of a brick wall should be recognized as an architectural feature just as much as the bricks themselves; and so soon as this is done we begin to get a surface with texture. It has been difficult to convince the mechanic, who was taught, when learning his trade, to obliterate so far as possible all trace of the joint, that comparatively wide joints of mortar of a different color from the bricks themselves could make a workman-like-looking job, and it is often hard work to bring a man who has served his time to sacrifice his principles so far as to follow the architect's directions, and lay a wall where the mortar joint is conspicuous, both on account of its width and color; but in many instances the mechanic has freely admitted, when the work was finished and cleaned down, that after all it had a certain merit and pleasing appearance, which was lacking in that which was done in the old way.

Besides recognizing the joint by means of color, it is also oftentimes desirable to use a greater width, particularly in the bed joints, which necessitates the use of a much coarser sand than was formerly employed, so the bricks will not only stand up, but also stay in place. And if such work is laid in wet weather and a hard and non-absorbent brick is used, it requires some skill to keep the wall plumb and true, but this difficulty can be overcome by the exercise of a little care and attention.

While the cement or coloring matter, which may be mixed with it control to a considerable degree the color of the mortar, nevertheless, the sand has an appreciable effect, and where it is desired to get a light-colored joint, the best sand for the purpose is a coarse, white beach sand, the only objection to it being that it is not as sharp as some bank sands, but this fact is not of sufficient importance, however, to interfere with its use. It was formerly quite generally supposed that the presence of salt in mortar was detrimental to its strength; it has been proved of late, however, that just as good mortar can be made with salt water as with fresh; and the government, on its most important works, as sea walls, lighthouses, and similar constructions, allows the mortar to be mixed of salt water.

It may be said that, as a general rule, a joint lighter than the brick is the most preferable, and a strong mortar of this kind may be made by starting with a pure lime and sand putty, and tempering it strongly as it is used with Portland cement. Care must be taken, however, in cleaning down a wall which has been laid with a wide joint of lime mortar, that the lime is not taken out of the joint to such an extent that the wall is whitewashed. If acid is used, it should be in very small quantities; but it is better to clean such brickwork with soda instead of acid, which, if the mortar is fairly well set, rarely starts the joints. It is also important that walls laid as described above should be laid so as to have ample time to become set before winter weather sets in. Care should also be taken to ascertain if there is any trouble liable to occur on account of unequal shrinkage in the mortar between the face of the wall and the backing. At one time it was often customary to lay the facing of brick walls, or at least a portion of it, in clear Portland cement, to allow the brick to be carved like stone after being set in place. There are instances where the unequal shrinkage or expansion of the different kinds of mortar made the facing scale off, and in time necessitated the removal of the entire outer 4 ins. of brickwork, but such trouble is undoubtedly less liable to occur with a wide joint in the facing, for in this case the joints of the facing and backing are more nearly equal.

Before the mortar between the bricks is set it is customary to "joint" it, that is to say, to compress it more or less by running an iron tool with a smooth surface along the joint, which compresses and at the same time indents the mortar. The jointer usually has a V-shaped edge which makes a sharp, narrow line, but sometimes a U one, which makes a slight indentation the full width of the joint. A good effect is obtained in some cases by simply cutting the mortar off with the trowel flush with the surface of the brick; but as this leaves a rough surface, the mortar is more liable to be affected by frost than where it is smoothed and compressed with a jointer. In jointing brickwork, where the bricks themselves are more or less irregular in shape and laid with a wide mortar joint, it is usually desirable to have the jointer run along the top of a straightedge, which is carefully leveled each time. Although the method of jointing the mortar may seem at first thought an unimportant detail, yet experience will soon show that it is a matter which deserves careful attention, particularly on work which comes near the eye, as in the case of fence walls, gate posts, and other similar work. If, when the architect is to build a brick wall where he wishes to obtain the best possible results, he will have several samples laid up with the same brick but different joints, he will find that the difference in joints may determine whether or not the wall is satisfactory in both color or texture, and also that a poor brick may be helped, or a good one injured, by the color and width of the mortar. The brick joint is a factor much more important than is generally supposed, and is worthy much more consideration than is ordinarily given to it.

SAND.—Sand should be sharp, gritty, and clean, free from loam, clay, and other foreign substance. For mortar it should be screened to a proper degree of fineness. To test sand, take up a handful and squeeze. Its sharpness may be determined by feeling, and cleanness by the appearance of the hand, as clay or loam will soil the hand by clinging to it. A better test for cleanness is to drop a handful into a glass of clean water; dirt will not settle at the bottom, sand will.

COST OF CONCRETE.—With Portland cement at $2.20 per barrel, sand at $1.00, and broken stone at $2.00 per cubic yard, and labor at $2.40 per day of eight hours in New York City, builders get from 30 cents to 32 cents per cubic foot for concrete in place. In the repaving of Fifth Avenue, New York City, in 1887, with Rosendale cement at 90 cents per barrel, labor at $1.50 per ten hours day, sand at $1.00, and broken stone at $2.00 per cubic yard, the contract price was $4.00 per cubic yard in place, a perfectly fair estimate, the mixture being about 1 — 3 — 5, and laid 12 ins. deep over the entire 40 ft. wide roadway.

Recent Brick and Terra-Cotta Work in American Cities, and Manufacturers' Department.

NEW YORK. — Another month of unusual activity in the Building Department has just passed. The plans which have been filed include several very important large buildings, the designing of which, we are happy to say, have been placed in good hands and we need not be apprehensive of the result. We have it on good authority, however, that several of the buildings whose plans have been filed will not be erected immediately, this formality having been gone through so that their ultimate erection need not be prevented by a bill now under discussion in the State legislature, limiting the heights of buildings.

CAPS TO COLUMNS AT FIFTEENTH STORY, ST. JAMES BUILDING, NEW YORK CITY.
Bruce Price, Architect.
Made by Perth Amboy Terra-Cotta Company.

An item of particular interest is the decision of the owners to sell Madison Square Garden, the largest and most beautiful amusement place in America. All who are interested in the use of brick and terra-cotta know how successfully and how beautifully these materials have been blended in this splendid structure. The owners cannot be too highly commended for their generosity and public spirit in their endeavor to give the city of New York a building of which she is justly proud, nor the architects, McKim, Mead & White, for their eminently successful handling of the problem. The great building has proved an unprofitable adventure financially, and during only one or two years has it paid expenses. It is not likely that its sale will materially affect the appearance of the building, although the Madison Avenue section may be remodeled into an hotel.

A new building which, judging by the drawings, promises to be a handsome one, is the new Herald Square Hotel, by Hill & Turner, architects. This building will form a background to that admirable copy, the Herald Building, and will not artistically help the latter.

As a result of the generosity of Miss Rhinelander, a beautiful group of buildings will be erected on her grandfather's estate, for which purpose she has given over $500,000. The property is on the south side of East 82d Street, between First and Second Avenues, and the buildings to be erected will be dedicated to the purposes of St. James Parish.

Plans have been completed by R. H. Hunt for an addition to the Metropolitan Museum Building, which will cost $1,000,000. The bids for the foundation work have been received and the work is about to commence. This is an important step toward the completion of a grand museum, of which the present structure is only a nucleus. The proposed wing will be classic in the general style of its architecture and will be constructed of brick and granite. It is a very elaborate building and will probably take two or three years to complete.

Plans have been filed for a magnificent new home for the University Club. The building will be erected on the plot of ground at the northwest corner of Fifth Avenue and 54th Street, which was bought for $805,000. The architects are McKim, Mead & White. It is to be a handsome and substantial structure, and the interior arrangements, as indicated by the plans, are remarkably complete.

An office building will be erected at Nos. 225 and 227 Fifth Avenue for the Baroness de Salliere. It will be twenty stories high and will cost $500,000.

Harding & Gooch have prepared plans for a sixteen-story office building for John A. Roebling & Sons, to be erected at Nos. 117 to 121 Liberty Street. It will be of steel skeleton construction with a front of brick, stone, and terra-cotta. It is estimated to cost $500,000.

The same architects have also filed plans for a fourteen-story building to be erected for J. Hooker Hammersley at the southwest corner of John and William Streets. It will be only 27 by 78 ft. in size, but will cost $400,000. The front will be of granite and brick, with terra-cotta trimmings.

R. Maynicke has prepared plans for a twelve-story store and office building to be erected at No. 598 Broadway for Henry Corn. The cost will be $250,000. Also another similar building for the same owner at Fifth Avenue and 22d Street, to cost $200,000.

Neville & Bagge have planned seven flat buildings to be erected on St. Nicholas Avenue, at a cost of $190,000.

Clinton & Russell have prepared plans for a twelve-story brick building, Nos. 11 to 15 Murray Street, to be used for manufacturing purposes. It will cost $225,000.

Schickel & Ditmars have planned a five-story brick office building to be erected at Fifth Avenue and 91st Street, at a cost of $25,000.

C. C. Haight has prepared plans for an Hospital for the Ruptured and Crippled, to be built at 42d Street and Lexington Avenue. The cost will be $250,000.

Schneider & Herter have planned a six-story brick and terra-cotta tenement, 100 by 100 ft., to be erected at the northeast corner of Columbia and Delancey Streets, at a cost of $95,000.

Henry O. Havemeyer has sold to John S. Ames a plot, 150 by 200 ft., on Broadway, north of Prince Street, for $100,000. Mr. Ames intends to erect three twelve-story mercantile buildings.

TERRA-COTTA DETAIL, AMERICAN BAPTIST PUBLICATION SOCIETY BUILDING, PHILADELPHIA.
Frank Miles Day & Brother, Architects.
Made by Conkling-Armstrong Terra-Cotta Company.

PHILADELPHIA.— The removal of the capitol from Harrisburg to this city will apparently not take place, the project which was so vigorously advocated immediately after the burning of the capitol has been abandoned, and there will be a new building, for capitol purposes only, erected at Harrisburg upon the site of the burned structure.

STATE CAPITOL AT HARRISBURG, PA.

We visited the ruins shortly after the fire. If any bricklayer or mason desires to have an object lesson which will illustrate perfectly what has been said concerning good brickwork in the editorial department of THE BRICKBUILDER in the early editions of this year, he can get it there. We were so impressed with the stability of the walls after passing through so intense a fire that we had photographs made of the ruins, and present them herewith. Nowhere throughout the entire structure are they seriously injured. Over the openings, both large and small, the lintels burned away, and a few bricks fell with them; there are no cracks to be seen, and bulged walls or even isolated piers are out of the question; everything stands as perfect as it could be built new at the present time, especially the dome, which bore the brunt of the fire, and is standing today in a condition which would require only a few days' work to place it in the same condition that it was in before the fire. Notice, also, that on the front of the building the piers which supported a large pediment are still standing perfectly vertical, the woodwork having burned away, and the rafters fallen without injuring them in the least. The slender chimneys on either side of the dome, as well as the more sturdy ones on the outer walls, are all standing, the joists and rafters fell without any damage to the walls, leaving only the black openings which once held them; the interior piers which carried girders also remain standing in good condition. These walls were built in strictly plain and logical manner with good materials, they are laid in Flemish bond throughout, there being no exterior facing shell of wall bonded to the backing every seventh course, as we now have it in nearly all of our work. We cannot see why any architect who will view this mute but eloquent example of the durability of real good, honest brick-work should allow any of his work to be constructed in any other manner.

STATE CAPITOL AT HARRISBURG, PA. SHOWING EFFECTS OF FIRE.

The competition which has been announced by the Commission having in charge the selection of an architect for the new capitol, has been arranged for the Commission by their adviser, Prof. Warren Powers Laird, of the School of Architecture, University of Pennsylvania, and is designed to bring into the competition the best talent in the country, especial provisions having been made in this direction by the selection of six architects from those standing at the head of the profession, three of whom shall be from Pennsylvania and three from other States, who have been invited to submit designs, and who will be paid $1,000 each in compensation for taking part in the competition, but they shall not have any preference whatever in the selection of the design by reason of their being invited into the competition and paid by the Commission. The program insures the selection from the designs submitted, by a board of experts composed of three persons, the first of whom shall be the adviser of the Commission, Professor Laird; the second to be chosen by a majority of the six invited architects; and these two to select a third, of eight designs which in their judgment are best, giving to each their rank in accordance with their merit; these designs will be presented to the commissioners together with a full report of the proceedings of the board of experts, and such recommendations as they may deem necessary. The commissioners will select from the eight designs submitted by the board of experts, and will in nowise consider any of the others. The one which shall be selected as the most satisfactory shall be so designated, and the author of it shall be employed as the architect of the proposed buildings, with full authority as such, and shall be paid a commission of five per cent. of the cost of the work; two bronze medals shall be awarded to the authors of the designs adjudged as second and third respectively by the commissioners. No use of any other design or part of design shall be made unless by the consent and compensation of the author of it, and the drawings will be returned to the authors upon the conclusion of the competition, together with a full report of the board of experts and the Commission.

The program calls for a design for three department buildings in a group, the chief of which shall be the legislative building. The designs shall be sent to State Treasurer Haywood on or before 12 o'clock noon, Saturday, July 24, 1897, and the final selection of an architect shall be made not later than August 7. The drawings shall be enclosed in two separately sealed wrappers, the outer one of which shall be removed upon receipt of them; they shall have no marks whatever, as a number will be given each when the wrapper is removed, and this number shall be placed upon a sealed envelope containing the name of the author, which shall be enclosed with the drawings; these envelopes will be given to Judge Simonton, of the Dauphin County Court, to be opened by him after the selection of the design placed first.

The program has some unique features and is designed to overcome those which have made failures of most of the prominent com-

petitions of the past. It is very complete in every detail, and the result will be eagerly looked forward to by every person interested in competitions of this class.

CHICAGO.—We hear much of a great undertaking in the line of building a South Side lake shore drive connecting the Lake Front Park and Jackson Park. Mr. D. H. Burnham's name is prominently mentioned in connection with this enterprise, which is vast enough to require the issue of several millions in bonds before it can be realized.

The plan contemplates not only a driveway, but also roads for equestrians and bicycle riders, and these are to lie between the lake and a series of lagoons, while trees and shrubbery aid in making magnificent effects in the conception.

"Alterations" and "additions" form a large part of building items during times of business depression. Every few days one sees another store front undergoing transformation. A temporary sidewalk crowds passers-by out into the street, rows of blocking appear parallel with the front wall, a series of tall timbers with jackscrews in their lower ends form a dense colonnade outside, while another series extend in like manner inside the wall. Very soon needles of steel (I beams and rails) are made to pierce the walls and rest on the two rows of timber columns. Then the original supports are torn out, heavy brick piers and clumsy iron columns and mullions are removed, and for a time the building looms up in the air in a very awkward way on stilts, which seem to threaten to topple over at any moment. Slender columns and large sheets of plate glass are built in to give a maximum of light and show-window space, and then the owner is ready to offer inducements to prevent tenants moving into the new buildings. These changes in store fronts one and often two stories in height are a common sight in the business center of Chicago at present.

ENTRANCE TO COMMONWEALTH AVENUE RESIDENCE, BOSTON.
McKim, Mead & White, Architects.

TERRA-COTTA CAP, WAREHOUSE, W. 14TH STREET, NEW YORK CITY.
Thomas R. Jackson, Architect.
Made by the New Jersey Terra-Cotta Company.

Mr. S. A. Treat, architect, has several buildings on the boards.

Howard Shaw and Hugh M. G. Garden each have some fine residence work for professors in the University of Chicago. The latter is designing, also, a hunting lodge or camp to be built in the wilds of Maine for a Chicago professor of philology.

Mr. Clinton J. Warren has in hand plans for transforming a four-story mercantile building into an eight-story hotel.

An organ factory costing $60,000 is being constructed under the direction of J. H. Wagner.

Some boulevard residents in Chicago have recently had the pleasure of paying $9,000 to prevent the building of an apartment building out to the lot line. This was reported to be a hold-up similar to one worked several times by a notorious builder of livery stables in residence districts.

ST. LOUIS.—The most important event in building circles this season has been the passage of the new building ordinance by the city council, and which went into effect on the 16th of April. The ordinance was prepared by a committee composed of members of the local chapter of the American Institute of Architects, the Master Builders' Association, and the Board of Public Improvements.

The committee made an exhaustive study of the building ordinances of the principal cities of this country and Europe, with a view of obtaining results in keeping with the requirements of modern times. The object has been to point out the things not to be done, rather than to prepare a specification for the architect.

The standard of buildings has been raised, and all buildings used for public purposes, such as theaters, etc., as well as buildings over 100 ft. high, are to be fire-proof, while the height of no building is permitted to be more than one and a half times the width of the street upon which it faces, and in no case to exceed 150 ft.

The passage of the ordinance occasioned quite a rush in the Building Commissioners' office the early part of the month to obtain permits before the law became effective, which resulted in permits being taken out for a twenty-story office building on 6th and Olive Streets, for which Messrs. Wheeler & McClure have prepared plans, and for a twenty-two-story building for the northeast corner of 7th and Olive Streets, opposite the Union Trust, plans for which were prepared by Architect Isaac Taylor. Also, for a theater on the corner of 6th and St. Charles Streets, for which J. B. McElfatric and Kirchner & Kirchner are the architects.

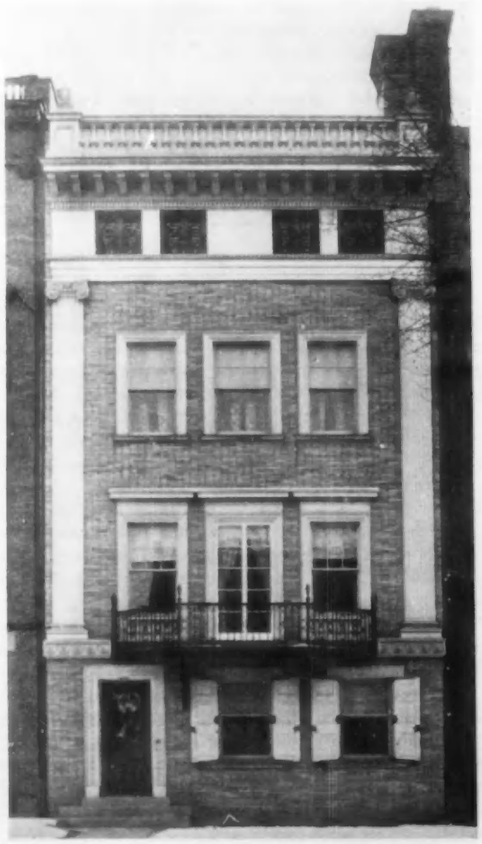
Sometime last summer, when the question of limiting the height of buildings was first agitated in the city council, a permit was

issued for a twenty-two-story office building on the southwest corner of 7th and Olive Streets, and all tenants were required to move preparatory to the wrecking of the old buildings, but the scheme seems to have been abandoned, and the premises have again become occupied.

TERRA-COTTA DETAIL, BUILDING FOR FERGUSON ESTATE, DETROIT.
Mortimer L. Smith & Son, Architects.
Made by Northwestern Terra-Cotta Company.

PITTSBURG. — Building projects are on the increase and new contemplations are reported nearly every day, among which is a ten-story building which F. Nicola, Esq, will erect, corner Penn Avenue and 4th Street, to cost $150,000. The Civic Club are considering plans for a new bath house to be erected on Penn Avenue, at a cost of $25,000. Architects Rutan & Russell are preparing plans for a central armory building, to cost $300,000. Architects Alden & Harlow are preparing plans for the South Side branch of the Carnegie Free Library, to cost $50,000. Architect Miss Elsie Mercur has been selected to prepare plans for the Washington, Pa., Female Seminary. Architect J. T. Steen is preparing plans for a brick church for the Cristion Congregation at Connellsville, Pa. Architects Riddle & Keirn are preparing plans for the Ninth U. P. Church, to be erected in Allegheny, to cost $20,000. Architect F. Sauer is preparing plans for a brick hotel to be erected at New Kensington, Pa. Architects E. J. Butz & Co. are preparing plans for the Lafayette Club house to be erected at Jeanette, to cost $10,000. Architect Chas. Bickel has prepared plans for an hotel and apartment house for J. Kaufman and others, to be fire-proof, of brick with terra-cotta trimmings, and to cost $200,000.

TERRA-COTTA CAP, OFFICE BUILDING, 78 FIFTH AVENUE, NEW YORK CITY.
Albert Wagner, Architect.
Made by White Brick and Terra-Cotta Company.



RESIDENCE AT BUFFALO, N. Y.
Broughton & Johnson, Architects.

PREVENTATIVE FOR DISCOLORATION ON FRONT BRICKS.

WE have recently had our attention called to the use of carbonate of barytes for the prevention of scum and discoloration on front bricks, terra-cotta, etc., and realizing the general interest the question bears to clay manufacturers, we quote the following extracts, translated from the German essay by W. Olschewsky, C. E. in *Ziegel und Cement.*

"Nearly all clay contains salts soluble in water; of these, the sulphuric acid salts, which are present in very fluctuating quantities in the clay used for bricks, terra-cotta, etc., are the most objectionable, as they cause scum and consequent discoloration. Most elaborate and costly alterations of kilns, etc., have often been made without effecting any cure of the evil. The cause is not in the burning or construction of the kilns, but to be found in the fact that scum and discoloration are already on the surface, before the bricks, etc., enter the kiln."

"Excellent and complete as the action of carbonate of barytes is as a cure for scum and discoloration from the chemical point of view, the practical man will nevertheless rarely obtain the desired result, if he adds the carbonate of barytes at random. To make this clear it is only necessary to say that sulphate of lime (gypsum) can be present in two different forms in the clay, viz., in a finely divided state (powder) and in the crystallized state, and that the method of treatment differs accordingly."

"The most complete assimilation of the carbonate of barytes with the clay is a condition, to obtain satisfactory results quickly and with the least possible quantity."

"It is difficult, however, to make sure of such assimilation by mere grinding of the ordinary carbonate of barytes; unnecessary loss is nearly always the consequence, as part of such barytes does not act. The coarser the barytes is the greater the loss."

"A most important advance towards a rational use of carbonate of barytes has been made by Messrs. Walther Feld & Co., who now produce precipitated carbonate of barytes of a fineness and power of action which could scarcely be attained by the highest possible state of fineness of the ordinary product, apart from the great expense."

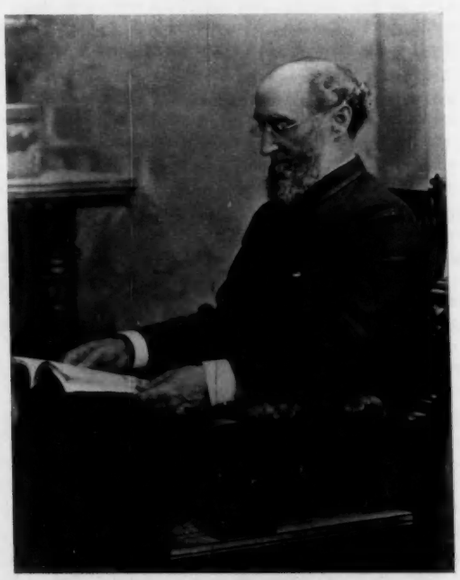
We may add that other valuable literature and practical information on this matter may be obtained by communicating with Gabriel & Schall, 205 Pearl Street, New York. They are the sole importers for the United States and Canada for Messrs. Walther Feld & Co.'s pure precipitated carbonate of barytes.

OBITUARY.

JAMES WILLIAMS PENFIELD, President of the American Clay-Working Machinery Company, died suddenly, April 20, at Cambridge Springs, Pa., where he had gone in hopes of regaining his health which had been failing for some time.

Mr. Penfield was born in Euclid, O., and at the time of his death was sixty-eight years of age.

Much of the progress that has been made in the clay-working art of this country is due to Mr. Penfield's inventive genius. A life



THE LATE J. W. PENFIELD.

of ambition, vigor, and tireless energy earned not only for him a unique reputation, but brought to the industry with which he was identified that creative force which is to-day felt wherever burnt clay is employed.

TRADE LITERATURE.

"25 to 40 per cent. saved in labor!" is the announcement made on the cover of the new catalogue issued by the Gilbreth Scaffold Company. The method by which this large percentage is saved is illustrated by eighteen cuts, showing the construction of the scaffold and its use in the various stages of masonry construction. F. B. Gilbreth, 85 Water Street, Boston.

NEWS OF THE MONTH.

MESSRS. WALDO BROTHERS, Boston, are the agents for the Atlas Portland Cement, also the Morse Wall Ties.

THE STANDARD FIRE-PROOFING COMPANY have removed their New York office to the Taylor Building, 39 and 41 Cortlandt Street.

I. W. PINKHAM COMPANY, Boston, are the New England agents for the Turnbull & Cullerton Patent Steel Lathing.

THE POWHATAN CLAY-MANUFACTURING COMPANY have removed their New York offices to the Townsend Building, 25th Street and Broadway.

THE WHITE BRICK AND TERRA-COTTA COMPANY, New York, have removed their offices to the Presbyterian Building, 156 Fifth Avenue.

I. W. PINKHAM COMPANY, Boston, have taken the New England agency for the Brooklyn Bridge Brand of Cement, also for the F. O. Norton Cement.

THE PENNSYLVANIA ENAMELED BRICK COMPANY, New York, have removed their offices to the Townsend Building, 25th Street and Broadway.

THE TIFFANY ENAMELED BRICK COMPANY, Chicago, will supply the enameled brick used in the Y. M. C. A. Building at Louisville, Ky., Val. P. Collins, architect.

J. W. HORNSEY has leased the plant of the Collinwood Brick and Terra-Cotta Company, Collinwood, Ohio, and will soon put upon the market a "High-Grade Impervious Brick."

THE STANDARD TERRA-COTTA COMPANY have secured through their New England agents, O. W. Peterson & Co., the contract for the terra-cotta on the church of the Blessed Sacrament at Providence, R. I. Heins & La Farge, architects, New York.

CONTRACTS have been closed for putting the Bolles Sliding and Revolving Sash in the following buildings: Six schoolhouses, New York City; Howard Auditorium, Baltimore; residence, John McHenry, Baltimore; residence, R. H. Yeatman, Baltimore.

THE TIFFANY ENAMELED BRICK COMPANY, Chicago, are now making enameled "soaps" having the same enameled face as the English size brick, but only one or two inches deep, as desired. Especially suitable where economy in space is necessary.

THE FAWCETT VENTILATED FIRE-PROOFING COMPANY, who have the fire-proofing contract for the new Registry of Deeds Building at East Cambridge, Mass., have placed their order for cement with Waldo Brothers, specifying Atlas Portland cement.

THE PHILADELPHIA AND BOSTON FACE BRICK COMPANY report the following new contracts: Gray brick for Slamm Building, at Washington, D. C.; cream brick for Steuben Street residence at Albany, N. Y.; gray brick for Angier Chemical Company Building at Brighton, Mass.

G. R. TWICHELL & Co., Boston, have closed the following contracts: Mottled brick residence for R. E. Lord, at Waltham, Mass.; gray brick for Baptist Church, Warren Street, Boston; front brick apartment houses, Waitt Street, Boston; and all the common brick to be used in the Russia Wharf buildings, Boston. C. Everett Clark & Co., builders.

THE TIFFANY ENAMELED BRICK COMPANY, Chicago, have appointed as their agents for the sale of enameled brick: W. S. Nelson, Kansas City, Mo.; Wm. J. Watkins & Co., Louisville, Ky.; Pittsburg Mortar and Supply Company, Pittsburg, Penn.; The Midland Brick and Supply Company, Cleveland, O.; B. S. Lewis, Nashville, Tenn.; Illinois Supply and Construction Company, St. Louis, Mo.

THE AMERICAN CLAY-WORKING MACHINERY COMPANY, of Bucyrus and Willoughby, Ohio, have opened a New York office in Room 103, 39 and 41 Cortlandt Street, New York, where they will be pleased to have all clay workers make their headquarters while in New York. The office will be in charge of R. C. Penfield, who will be pleased to attend to all wants of callers, whether they are probable

customers or not. The largely increasing Eastern trade of the company made it necessary to open a New York office.

D. P. GUISE, one of the leading clay workers of Pennsylvania, has placed an order with the American Clay-Working Machinery Company for an Eagle Re-press. The Guise works will be further improved and will enter upon the new season fully equipped to get its share of the business.

CHAMBERS BROTHERS COMPANY have recently closed contract with the C. P. Merwin Brick Company, of Berlin, Conn., for one of their auger machines, with outfit of clay-preparing machinery in connection therewith, to make for them hollow building brick. At present there are large quantities of these bricks imported into their market from New Jersey, and after careful test they find that their own material is entirely satisfactory for the manufacture of these bricks, and have determined to equip for their manufacture.

CHARLES T. HARRIS, Lessee Celadon Terra-Cotta Company, will supply the roofing tiles on the following work: Residence for G. W. Fairchilds, Oneonta, N. Y.; A. W. Fuller, architect, Albany, N. Y. Residence for H. C. McCormick, Williamsport, Penn.; Bennett & Rothrock, architects. Residence for W. J. Frisbie, Camden, N. Y.; Gordon A. Wright, architect, Syracuse, N. Y. Art Gallery for J. W. Kaufman, St. Louis; Link & Rosenheim, architect.

THE contract to furnish all the Portland cement required for the construction of the new South Terminal Station, Boston, which will be one of the very largest railroad stations in the world, has been awarded to James A. Davis & Co., 92 State Street, Boston, sole New England agents for the Alpha Portland Cement. This brand will be used exclusively in this important work. Shepley, Rutan & Coolidge are the architects, and Norcross Bros., builders.

THE AMERICAN MASON SAFETY TREAD COMPANY have just completed their contract for laying their Safety Tread on the new grand staircase of Messrs. Jordan, Marsh & Co., Boston.

These iron steps were originally made with a recess cast for rubber mats, nearly to the edge, leaving exposed, however, the iron nosings, which wore smooth, and proved a source of danger to both customers and employees.

The new Southern Railroad Station of the Boston Terminal Company, the Lowell Post-Office, the Boston Subway, and several new mercantile buildings are also being equipped with the Treads.

THE AMERICAN ENAMELED BRICK COMPANY, New York, have recently closed a contract with Norcross Bros., builders, and McKim, Mead & White, architects, for light buff front brick, including special fluted bricks for columns and pilasters in the interior of the Columbia College Gymnasium; also a large order for enameled brick to line the plunge bath there, in addition to the order recently filled for the same parties for another portion of the University Hall Building.

They have also secured contract for the enameled brick to be used in lining the Swimming Bath of the New York Athletic Club; these bricks to be made specially and glazed on the flat side.

THE COLUMBUS BRICK AND TERRA-COTTA COMPANY, Columbus, O., one of the very largest front brick manufacturers in the country, have recently supplied their brick for the following residences: Residence, Riverside Drive, New York, M. V. Ferdon, architect, light-gray Romans; residence for J. T. Blair, Columbus, O., terra-cotta and gray standards; residence for E. M. Huggins, Columbus, O., dark-gray standards; two residences for J. H. Outhwait, Columbus, O., gray Romans and standards; residence for W. H. Martin, Columbus, O., gray Romans; residence for Henry Flesh, Piqua, O., Peters, Burns & Pretzinger, architects, dark-gray Romans; residence for Mr. Kavelidge, Milwaukee, Wis., gray speckled and light-gray standards; residence for Mr. Manegold, Milwaukee, Wis., dark-gray standards; residence for Charles L. Kurtz, Columbus, O., Yost & Packard, architects, gray and buff Romans; residence for Dr. H. G. Campbell, Logan, O., terra-cotta standards.

THE HYDRAULIC-PRESS BRICK COMPANIES.

THE Hydraulic-Press Brick Companies, although including thirteen separate and distinct organizations, located in nine States of the Union, may nevertheless be referred to as one company, whose history is replete with records of uninterrupted success from the time of its inception. The parent company was organized in St. Louis over thirty years ago, and since then the establishment of the several branch companies at different intervals and in various parts of the country attest the tremendous growth of the business and its far-reaching influence. The various plants are located at points stretching from as far west as Nebraska to as far east as New Jersey, and in a northerly and southerly direction from Minnesota to Virginia. Thus it will be perceived that working eastward the invasion of new territory by the Hydraulic-Press Brick Companies has been so constant and thorough as to render impossible one's successfully eluding their influence or finding a place where their bricks are an unknown quantity.

There has been a wonderful evolution and revolution in brick manufacturing even during the past decade. Formerly a brick-yard need only produce a good red or a good buff to secure enough orders to make their business profitable, because a very limited number of colors were used. So great a variety of new shades have been put on the market, and at once adopted by those seeking new effects, and more perfect harmony between brick and stone trim, and so widely divergent is the taste of architects and builders, that, to successfully compete on all kinds and grades of work, a brick-yard must now be able to make a large assortment of colors that possess enduring qualities beyond question. The Hydraulic Companies, keenly alive to this necessity, have kept it constantly in mind, and by developing the full possibilities of their old plants, and only starting new ones when the clay at hand would permit of producing a variety of shades, have succeeded in obtaining a most complete assortment of colors. When it is stated that the Eastern Hydraulic-Press Brick Company alone makes thirty distinct shades of front brick, and that all the other companies have also a large and distinct variety, the reader may form some idea of the extent of the assortment. Thus it is possible for them to satisfy the taste of the most fastidious, and furnish something that will harmonize with any combination of terra-cotta or stone trimming that the fancy may prefer.

These companies have been among the first to recognize the desirability of molded brick for the use of the architect, and under the direction of one of the foremost architects in Philadelphia, a gentleman of high reputation throughout the country, they have prepared a large number of shapes suitable for a variety of cases, and are prepared to supply these moldings in any quantity or color. These shapes and a number of suggestive sketches showing what can be done with moldings in bricks are admirably shown in a very artistic catalogue recently issued by the companies, forming a volume which has elicited unqualified approval from all the architects who have seen it.

To the architect and builder, the enormous facilities and unparalleled resources of the Hydraulic-Press Brick Companies are two of their most attractive features. Their production, amounting to considerably over 300,000,000 bricks annually, enables them to serve any number of buildings requiring large quantities of bricks without subjecting any to the delays, so annoying and expensive, which in many instances have brought a large office building beyond the renting season necessitating a valuable piece of property being carried from six months to a year with all outgo and no income. Particularly in cities like New York, having strict building laws which prohibit a building being carried up to but a very limited height without the front walls being laid, is the matter of prompt and efficient service, one of the most important considerations in awarding the contract for face brick.

Also, it is of the greatest importance that a concern handling front brick should be at all times conscious of the extent of their ability to execute orders entrusted to their care, so that in estimating

or submitting proposals for bricks to be furnished within a specified time they can be able to satisfactorily show their resources. The Hydraulic-Press Brick Companies are so organized that such a thing as a serious delay in supplying brick is almost an impossibility. The solicitors of the companies are constantly posted concerning the stock on hand and in process of manufacture, and know the exact quantity that may be offered for immediate delivery over and above orders previously taken. All salesmen are provided with this information in so condensed a form as to permit of their carrying with them the necessary papers for reference, and thus, wherever they may be, and without consultation with their respective offices, they can supply a customer with accurate and reliable information as to whether the bricks he wishes to purchase are available for immediate delivery, or, if needed, just the amount of time required to furnish them.

A first-class material, brought before the public by a perfect organization and a complete system, backed by the most thorough business principles, is the secret of the financial success which has attended the efforts of the Hydraulic-Press Brick Companies.

The Companies also make a great feature of their exhibits, which are arranged in panel form with a view to displaying the bricks so as to fairly represent their appearance when laid in a wall, as well as affording a visitor the opportunity of seeing the full line of colors located in a manner easy of comparison. This greatly facilitates reaching a final decision as to the shade desired, and is infinitely more satisfactory to the customer than being required to judge of the effect which a brick will produce *en masse* by seeing merely a single sample. A full line of molded shapes are also displayed, and good-size specimens of various-colored stones are kept on hand for the convenience of visitors who may desire to ascertain the effect of certain combinations of brick and stone. These panel exhibits are arranged in most all the offices, but particularly here in the East, where, without an exception, they are equipped to display the bricks in the manner explained above.

Aside from the home offices, which are located at points in close proximity to the respective factories, there are many branch offices, one of the most prominent of which is the one in the Metropolitan Building, corner of 23d Street and Madison Avenue, New York, under the direction of Messrs. Fredenburg & Lounsbury, who are, in fact, the sole selling agents in New York and New England of all the Hydraulic Companies. Notwithstanding the fact that the New York and New England markets were the last in which the hydraulic bricks have been offered for sale, the volume of business done in New York and Brooklyn alone in '95 and '96 included the furnishing of high-grade front bricks for 1,288 buildings, an average of more than two for each working day. This is entirely exclusive of the New England business, which has grown to such proportions that a spacious new exhibit room has recently been opened in the Equitable Building, Boston. The exceedingly handsome panel exhibit displayed in this office is a revelation in its assortment of shades and qualities to those who are not familiar with the operations of the company.

In dealing with any of the Hydraulic-Press Brick Companies at their home offices, or with Fredenburg & Lounsbury, the customer comes in direct contact with the manufacturer, and will, therefore, receive that attention which is to be had only when dealing with principals.

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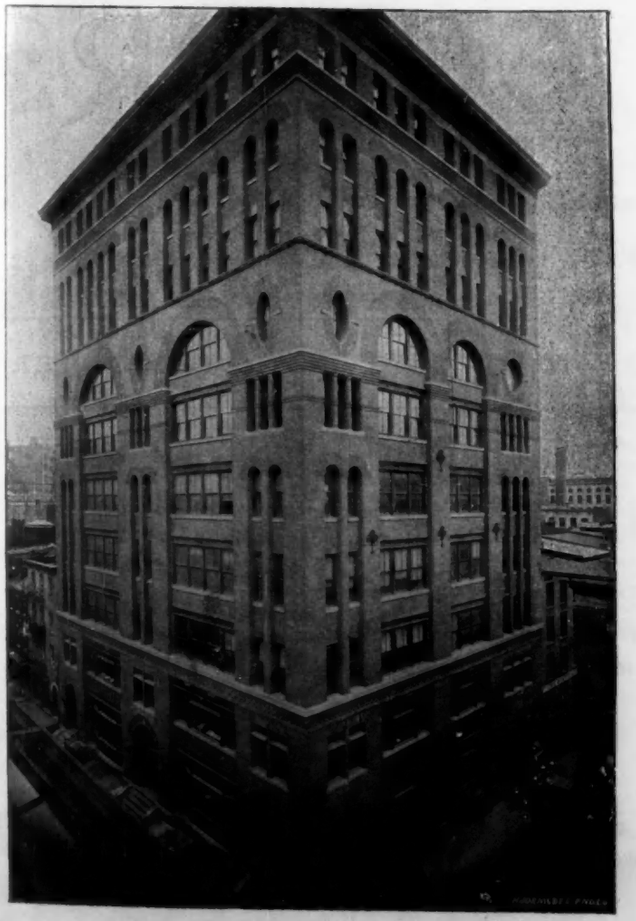

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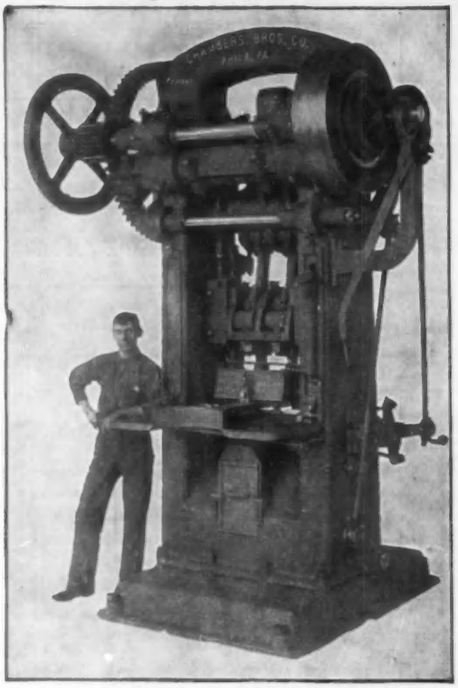


Manufactured by

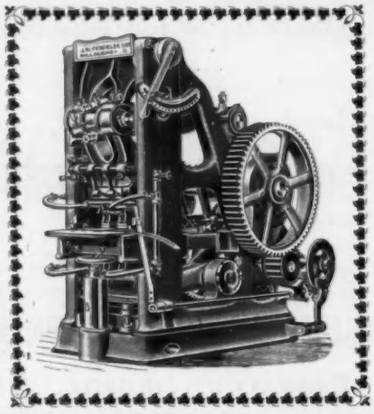
CHAMBERS BROTHERS COMPANY, Fifty-Second and Media Sts., PHILADELPHIA.

A strong, stiff machine, with all the pressing machinery above the mold box and away from the dirt. The finished brick is delivered up on a plate, and is never touched by the incoming clot. During the initial pressure any surplus clay in the clot is expelled, and all brick thus gaged to uniform thickness, following which all openings are closed and the finishing pressure applied in a practically tight box. The product is a repressed, tempered clay brick, free from blemish arising from method of delivery, and of practically uniform density and thickness.

"The Power of the Press!"

You often hear of "the Power of the Press" in regard to newspapers. An equally important matter is the power of the press for making pressed brick.

Builders say the brick made on our machinery are better than others; this must be attributed to "the power of the press." If you use our machinery it will help to make your product find favor with the builders.



We manufacture the most complete line of machinery and appliances in the world for making

Pressed Brick, Fire Brick, Common Brick, Sewer Pipe, and Fire-Proofing.

The American Clay-Working Machinery Co.,

BUCYRUS, OHIO.

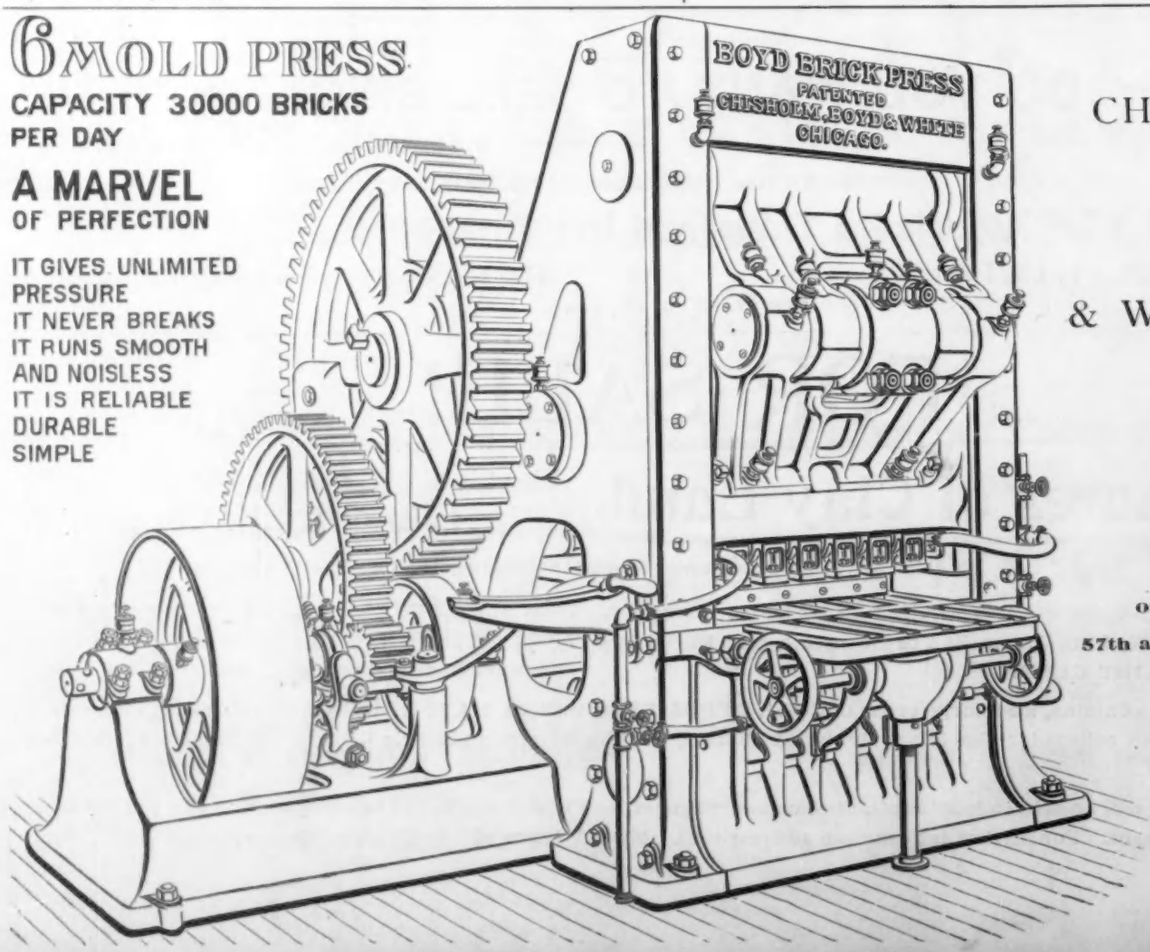
Long Distance Phone No. 90.

6 MOLD PRESS

CAPACITY 30000 BRICKS PER DAY

A MARVEL OF PERFECTION

IT GIVES UNLIMITED PRESSURE
IT NEVER BREAKS
IT RUNS SMOOTH AND NOISLESS
IT IS RELIABLE
DURABLE
SIMPLE



CHISHOLM,

BOYD

& WHITE CO.,

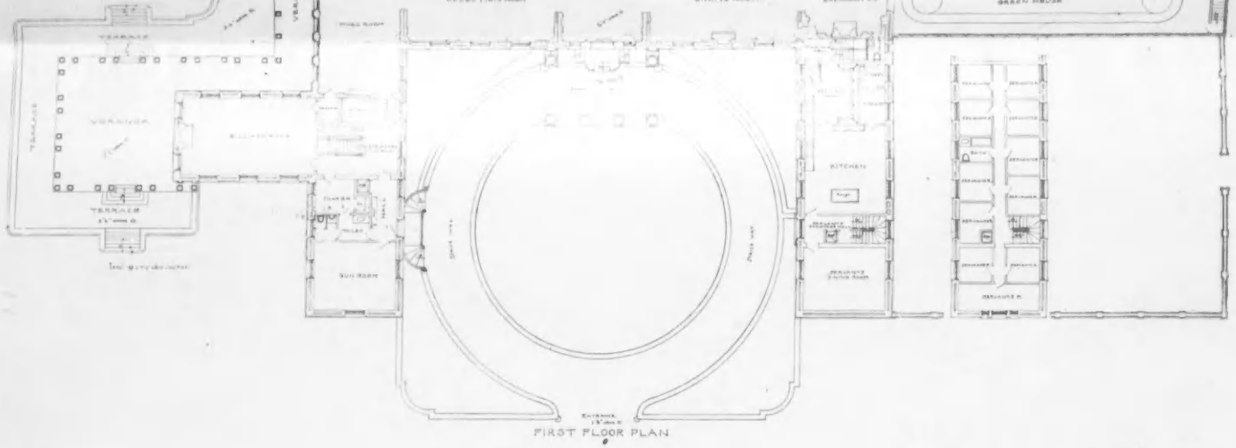
CHICAGO.

Office and Works:

57th and Wallace Streets.

REAR ELEVATION.

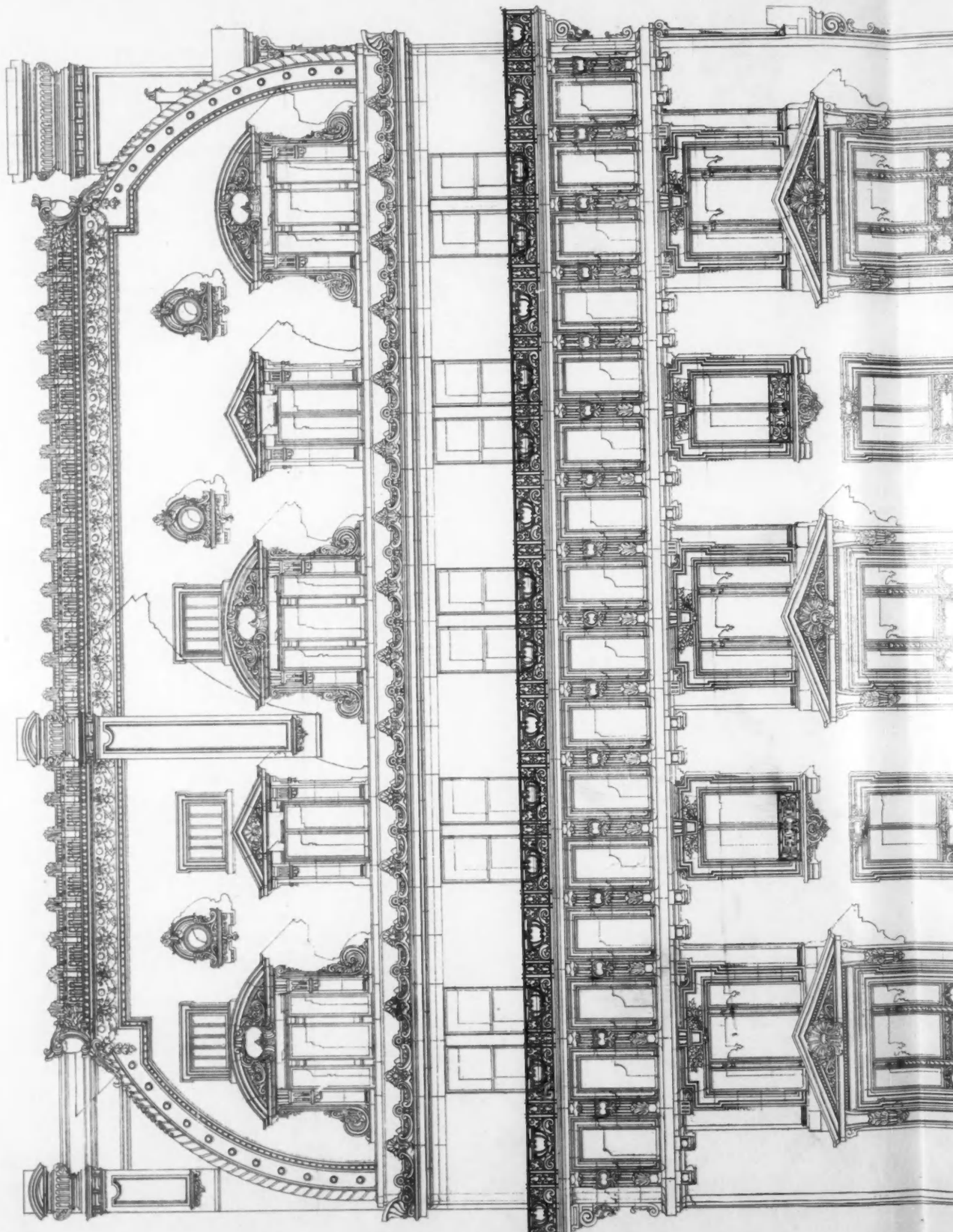
TERRACE
TERRACE
TERRACE

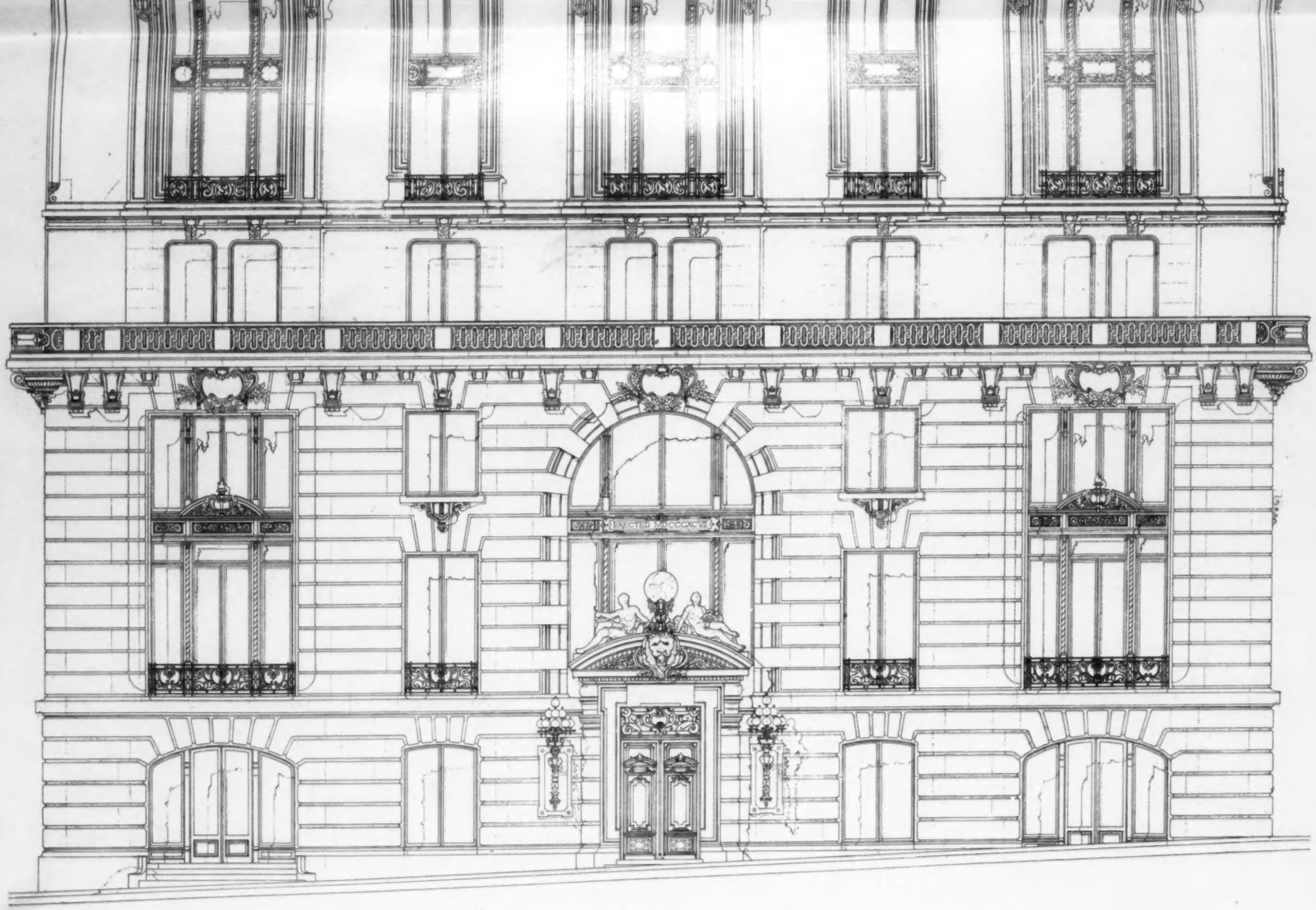


FRONT ELEVATION.

RESIDENCE FOR FREDERICK G. BOURNE, ESQ., OAKDALE, L. I.

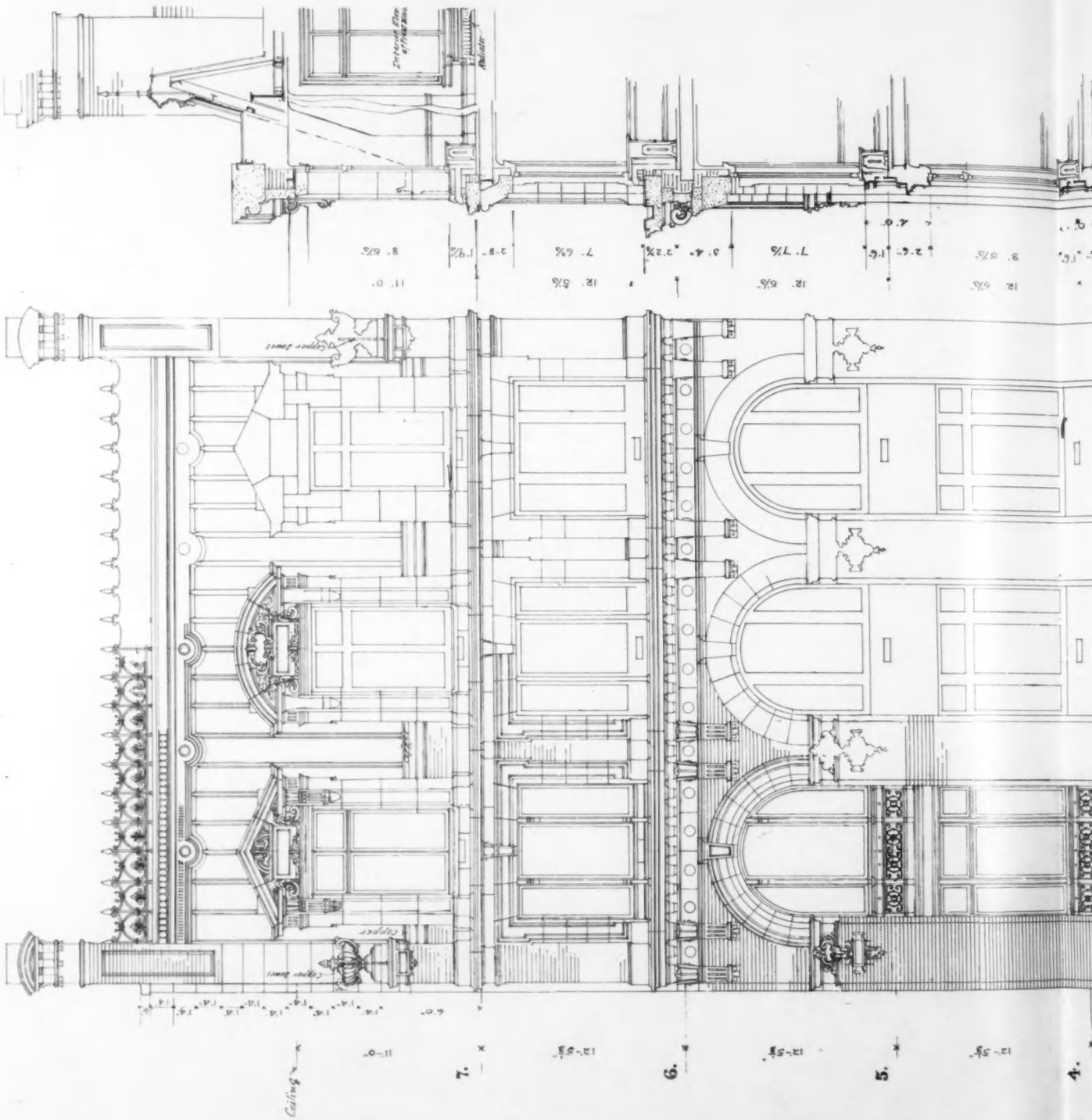
ERNEST FLAGG, ARCHITECT.

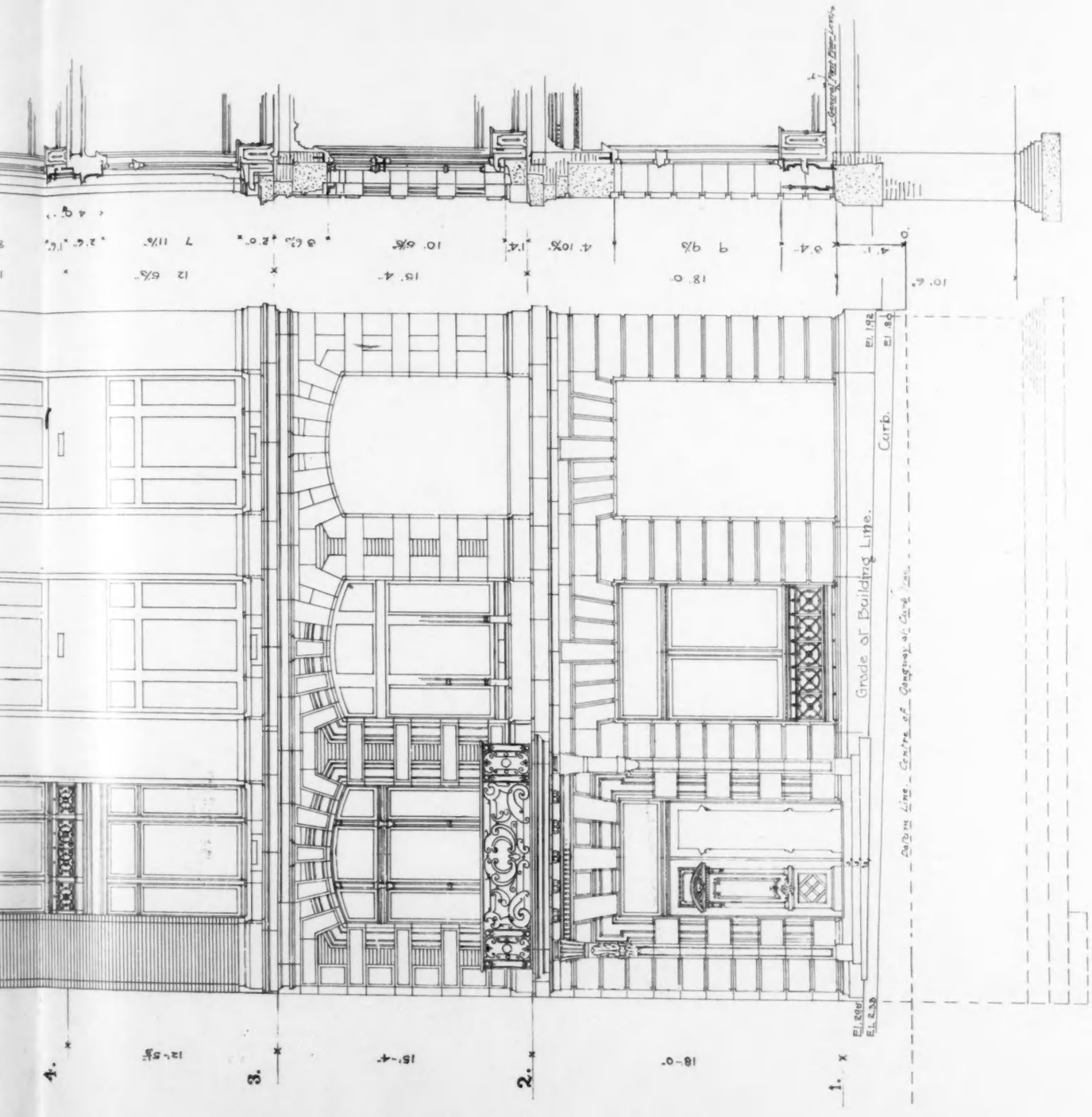




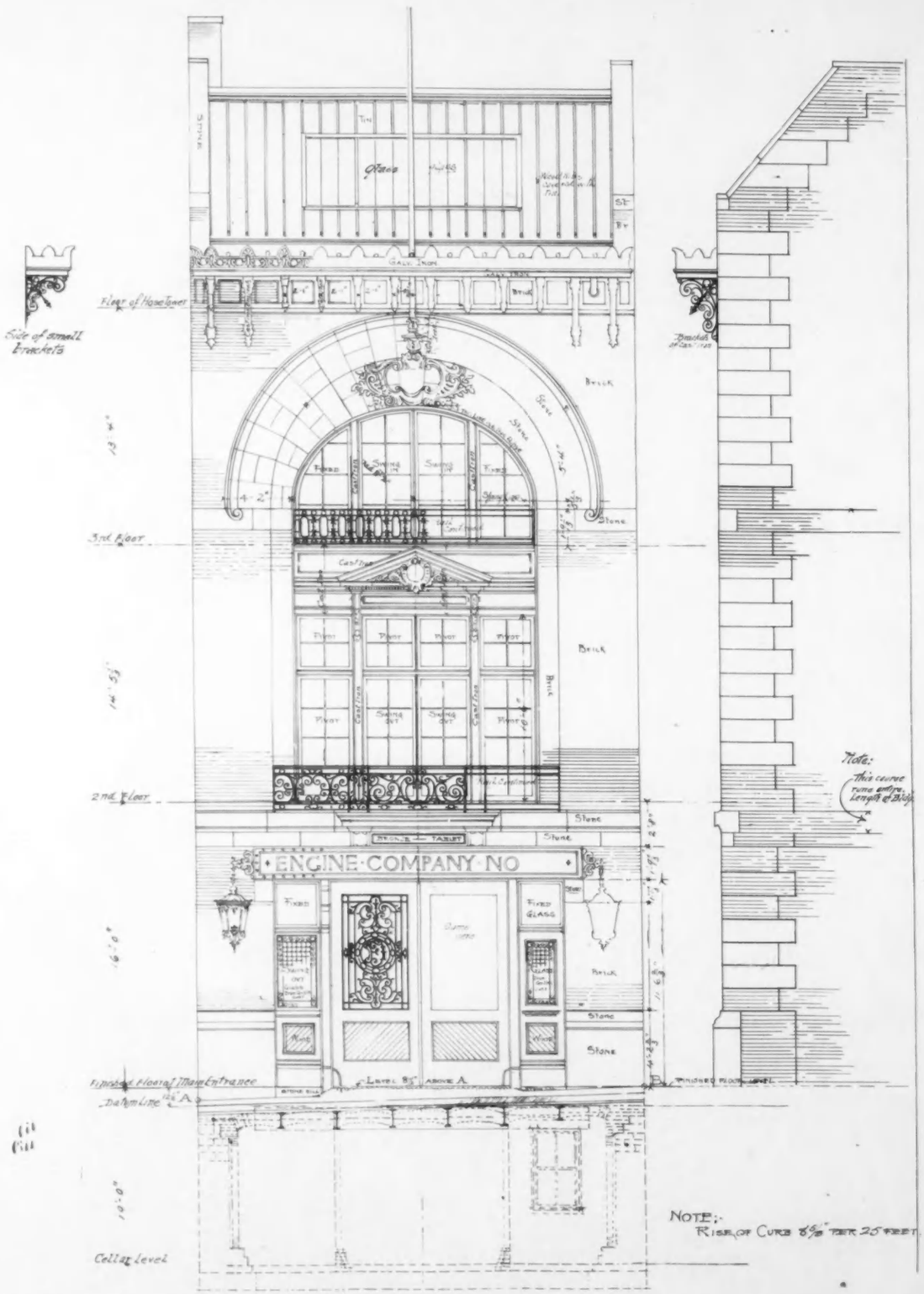
SINGER BUILDING, NEW YORK CITY.

ERNEST FLAGG, ARCHITECT.



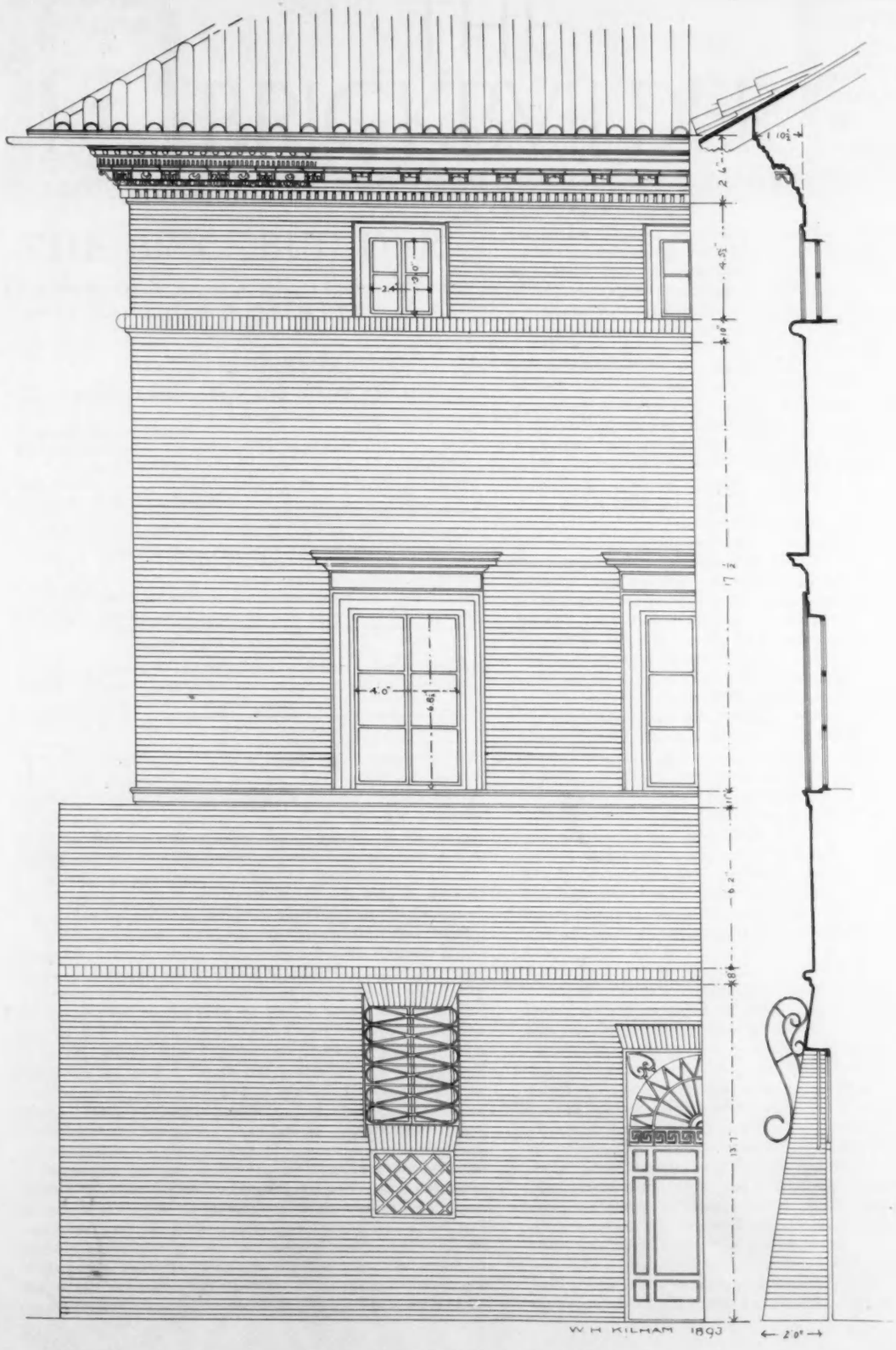


FIRST NATIONAL BANK BUILDING, HARTFORD, CONN.
ERNEST FLAGG, ARCHITECT.



ENGINE HOUSE, NEW YORK CITY.

ERNEST FLAGG, ARCHITECT.



DETAIL, PALAZZO POLLINI, SIENNA.

MEASURED AND DRAWN BY WALTER H. KILHAM (ROTCH SCHOLAR).